

PROJECT HEAR: HEALTH ENROLLMENT ASSESSMENT REVIEW
PHASE ONE: LITERATURE REVIEW, ANALYSIS, AND
RECOMMENDATIONS

Michael T. Halpern
Miranda I. Murray
Cynthia S. Palmer
Joseph A. Reblando
Steven W. Rust



Battelle Memorial Institute
Centers for Public Health Research & Evaluation
2101 Wilson Blvd, Ste 800
Arlington, VA 22201

OFFICE FOR PREVENTION & HEALTH SERVICES ASSESSMENT
2601 West Road, Suite 3
Brooks Air Force Base, TX 78235-5241

November 1994

Final Technical Report for Period July-September 1994

Approved for public release; distribution is unlimited.

19950419 076

AIR FORCE MATERIEL COMMAND
BROOKS AIR FORCE BASE, TEXAS

ARMSTRONG
LABORATORY

NOTICES

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

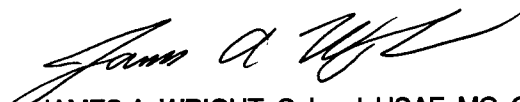
The mention of trade names or commercial products in this publication is for illustration purposes and does not constitute endorsement or recommendations for use by the United States Air Force.

The Office of Public Affairs has reviewed this technical report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This technical report has been reviewed and is approved for publication.



JOHN G. MEYER
Contract Monitor



JAMES A. WRIGHT, Colonel, USAF, MC, CFS
Chief, Office for Prevention & Health Services Assessment

REPORT DOCUMENTATION PAGEForm Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE November 1994	3. REPORT TYPE AND DATES COVERED Final -July-September 1994	
4. TITLE AND SUBTITLE PROJECT HEAR: Health Enrollment Assessment Review PHASE ONE: Literature Review, Analysis, and Recommendations			5. FUNDING NUMBERS	
6. AUTHOR(S) Michael T. Halpern Joseph A. Reblando Miranda I. Murray Steven W. Rust Cynthia S. Palmer				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Battelle Memorial Institute Centers for Public Health Research & Evaluation 2101 Wilson Blvd, Ste 800 Arlington, VA 22201			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES) Armstrong Laboratory (AFMC) Office for Prevention and Health Services Assessment 2601 West Road, Suite 3 Brooks Air Force Base, TX 78235-5241			10. SPONSORING/MONITORING AGENCY REPORT NUMBER AL/PS-TR-1995-0012	
11. SUPPLEMENTARY NOTES Armstrong Laboratory Technical Monitor: Mr. John G. Meyer, (210) 536-6515				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This report documents the initial phase of Project HEAR (Health Enrollment Assessment Review). The initial phase of the project examined the feasibility of developing an enrollment questionnaire for use in the Region VI TRICARE Prime, a health maintenance organization (HMO) which will become operational in 1995. The questionnaire will have three functions: assess preventive service needs of enrollees; predict which enrollees potentially will utilize high levels of medical resources or primary care manager (PCM) time; and recommend the appropriate level of PCM. Each function for Project HEAR is discussed separately in this report: 1) assessment of preventive service needs of enrollees, 2) prediction of high resources or PCM time utilization, and 3) assignment of appropriate level of PCM.				
14. SUBJECT TERMS Health assessment HRA HEAR Primary care manager HMO			15. NUMBER OF PAGES 140	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	v
INTRODUCTION	1
ASSESSMENT OF PREVENTIVE CARE NEEDS	3
LITERATURE EXAMINED	4
PURPOSE AND USE OF HEALTH RISK ASSESSMENT	4
IMPLEMENTATION OF HRAs	6
Group Strategies	7
Individual Strategies	7
HEALTH RISK ASSESSMENT USING NATIONAL SURVEYS	8
History	8
Behavioral Risk Factor Surveillance System	9
MILITARY HRA PROGRAMS	10
THE CARTER CENTER / CDC HRA	15
HRA IN PRIMARY CARE	17
CLINICAL PREVENTIVE SERVICES	20
Difficulties in the Implementation of Clinical Preventive Services ...	20
Healthy People 2000	22
Put Prevention Into Practice (PPIP)	23
HEALTH PLAN EMPLOYER DATA INFORMATION SET (HEDIS) ...	25
TABLE 1, SUMMARY OF HRA STUDIES	27
TABLE 2, HEDIS MEASURES	31
INTERVIEWS WITH SELECTED EXPERTS	38
LITERATURE AND INTERVIEW ANALYSIS	43
RECOMMENDATIONS	47

By _____	
Distribution/ _____	
Availability Codes	
Dist	Avail and/or
A-1	Special

TABLE OF CONTENTS (CONTINUED)

	Page
PREDICTION OF HIGH RESOURCE AND PCM TIME UTILIZATION	51
LITERATURE EXAMINED	52
CONSISTENCY OF HIGH RESOURCE UTILIZATION AMONG HMO	
POPULATIONS	52
METHODOLOGY AND LIMITATIONS FOR IDENTIFYING HIGH-	
UTILIZATION POPULATIONS	54
IDENTIFICATION OF HIGH RESOURCE UTILIZERS - GENERAL	
STUDIES	58
IDENTIFICATION OF HIGH RESOURCE UTILIZERS USING NATIONAL	
SURVEYS	65
HEALTH RESOURCE UTILIZATION AMONG PATIENT SUBGROUPS	68
Mental Health Patients	68
Elderly Patients	71
Cigarette Smokers	78
PREDICTORS OF HIGH PCM TIME UTILIZATION	79
TABLE 3, SUMMARY OF STUDIES EXAMINING PREDICTORS OF MEDICAL	
RESOURCE UTILIZATION	82
TABLE 4, FACTORS RELATED TO UTILIZATION PREDICTION	87
INTERVIEWS WITH SELECTED EXPERTS	89
LITERATURE AND INTERVIEW ANALYSIS	93
RECOMMENDATIONS	96
 LEVEL OF PRIMARY CARE MANAGER ASSIGNMENT	 101
LITERATURE EXAMINED	102
DIFFERENCES IN PCM REGARDING PATIENTS AND OUTCOMES .	102
PATIENT CLASSIFICATION SYSTEMS	104
TABLE 5, SUMMARY OF PATIENT CLASSIFICATION SYSTEMS	110
INTERVIEWS WITH SELECTED EXPERTS	111
LITERATURE AND INTERVIEW ANALYSIS	114
RECOMMENDATIONS	115
BIBLIOGRAPHY	118

EXECUTIVE SUMMARY

This report documents the initial phase of Project HEAR (Health Enrollment Assessment Review), performed by the Centers for Public Health Research and Evaluation, Battelle Memorial Institute, under contract to the Office of Prevention and Health Services Assessment (OPHSA), Armstrong Laboratory, Brooks Air Force Base. The initial phase of Project HEAR examined the feasibility of developing an enrollment questionnaire for use in TRICARE Region 6, a health maintenance organization (HMO) which will become operational in 1995. The questionnaire will have three functions: assess preventive service needs of enrollees; predict which enrollees potentially will utilize high levels of medical resources or primary care manager (PCM) time; and recommend the appropriate level of PCM.

Each function for Project HEAR is discussed separately in this report. Most of the report focuses on detailed literature reviews and expert interviews. For an overview of this information, we condensed the literature and interviews in tables and analysis within each section. Finally, our recommendations for each Project HEAR function are presented at the end of each respective section.

Each of the three Project HEAR functions is presented in this summary separately:

1. Assess preventive service needs of enrollees. Many health risk assessments (HRAs) perform a similar function to the Project HEAR preventive needs assessment; however, HRAs are targeted at supplying information on risk factors and behaviors to patients, while the HEAR questionnaire is designed to provide information to PCMs. A wide variety of HRAs are currently in use, including national surveys (e.g., the Behavioral Risk Factors Surveillance Survey) and standardized forms used at multiple sites (e.g., the Carter Center/CDC HRA). A number of HRAs are also used within the military health care system and the latest Department of Defence (DoD) Annual Survey of Beneficiaries is scheduled to be administered next year.

Standardized guidelines for preventive care needs are being created. A set of national objectives for preventive health, Healthy People 2000, has been established. A separate program, Put Prevention into Practice (PPIP), was developed by the U.S. Department of Health

and Human Services, Office of Disease Prevention and Health Promotion to assist in implementing Healthy People 2000. Finally, the HEDIS measures (Health Plan Employer Data Information Set) operationalize Healthy People 2000 objectives and specify the information to be collected for assessing preventive and clinical service outcomes in managed care systems.

Items from these national programs will form the basis of the preventive service needs assessment for the Project HEAR questionnaire; this will allow for collection of standardized information from TRICARE enrollees using pre-tested and validated questions. Additional questions will come from other standardized sources as appropriate, such as the BRFSS and DoD questionnaires. When necessary, new questions will be developed.

2. Prediction of high resources or primary care manager (PCM) time utilization. A number of studies have attempted to predict medical resource utilization for HMO enrollees, national survey respondents, or other groups. Characteristics associated with increased resource utilization include self-reported health status, functional status, prior health care utilization, absenteeism, chronic diseases, physical symptoms, mental health, health concerns, job/life satisfaction, and stress. However, these studies have been able to predict only a small amount of the variance in annual medical utilization.

Despite this, it is clear that a small group of individuals is responsible for the majority of medical resource utilization. Therefore, greater success may be achieved by identifying groups which are likely to utilize high levels of medical resources. Predicting which individuals belong to these groups involves the same characteristics as listed above; however, a different model is used for this analysis.

Little literature exists on predictors of high PCM time utilization. These studies focus on characteristics associated with increased length of ambulatory care appointments. In general, these characteristics are similar to those used to predict high resource utilization groups, but involving different analysis models.

To perform this objective of Project HEAR, we recommend collecting data on prior utilization, chronic diseases, attitudes towards health, and risk factors. In addition, data from a managed

care organization such as the Lovelace Foundation should be obtained to assist in developing and evaluating predictive models for medical resource and PCM time utilization.

3. Assignment of appropriate level of PCM. This function of Project HEAR has not previously been performed. A number of patient classification systems exist, categorizing individuals by disease severity or other attributes. However, these systems have been developed for use primarily with hospitalized inpatients. Further, the classification systems developed for ambulatory care patients cannot be used with only self-reported data.

Due to the lack of available information in this area, we recommend convening a panel of experts in primary care to develop criteria for categorizing PCM needs. An additional panel may also be needed to implement these criteria and deal with logistic difficulties in this implementation.

INTRODUCTION

The Office of Prevention and Health Services Assessment (OPHSA), Armstrong Laboratory, Brooks Air Force Base is supporting the Region 6 Medical Director in the development of TRICARE, a health maintenance organization (HMO) which will become operational in 1995. The Air Force will be the lead agent for this HMO, which will support a population of slightly over 1 million enrollees. All active duty military personnel will be required to enroll in TRICARE; dependents and retirees may choose between TRICARE, CHAMPUS Prime, or PPO options.

The Battelle Memorial Institute, Centers for Public Health Research and Evaluation, contracted to support OPHSA in developing an instrument to be completed by all enrollees at least 17 years old upon entering TRICARE. The development of this instrument and consideration of related issues were designated Project HEAR, Health Enrollment Assessment Review. The HEAR instrument will be a self-administered questionnaire which can be completed within 20 to 30 minutes at the time of enrollment. Further, the instrument is to be modular in design, so various components can be used separately in subsequent studies. Three components were defined for this instrument:

1. Assessing enrollee's risk factors and preventive care needs, for use by the enrollee's primary care manager (PCM).
2. Predicting which enrollees are likely to belong to groups which will be high utilizers of health care resources or of PCM's time.
3. Suggesting the appropriate level of training and expertise needed by the PCM for each enrollee.

This technical report examines these three component areas selected for the HEAR instrument. Each of these components is discussed separately in this report, but the overall format of each

section is similar. In each section, relevant studies and documents are reviewed. Studies were identified from computerized literature searches using MEDLINE, references from studies found by MEDLINE searches or in the possession of project personnel, and suggestions from experts in each field. Key methodologies and findings from this literature are summarized.

Next, a series of experts in each field was interviewed. These experts were selected based on the reviewed literature, suggestions from project personnel, and referrals from other experts we contacted. These interviews were informal telephone conversations; no pre-set instrument was used. The relevant component(s) of Project HEAR were described to each expert, who was then asked as to the state-of-the-art in the field and the feasibility of achieving the objectives of Project HEAR. Comments made during the interviews were recorded, and are summarized in each section. Interviews were included in this technical report to develop a more accurate impression of current trends in each field and to explore possible techniques and difficulties related to each HEAR component that the project team might have overlooked.

The reviewed literature and interviews in each section are summarized in an analysis section, which also discusses the implications of these findings and comments. Finally, we included recommendations concerning the implementation and analysis of these findings for the Project HEAR objectives and the TRICARE enrollment documents. A complete bibliography of all literature examined for this project is presented at the end of this report.

ASSESSMENT OF PREVENTIVE CARE NEEDS

In the last fifteen years health risk assessment (HRA) techniques have become an integral part of most programs in health education and are increasingly common in clinical preventive practice. HRAs will become increasingly essential for practitioners, accountable health plans, and HMOs because they serve to indicate the level of preventive care needed by individuals or groups. The major purpose of these instruments is to identify high-risk behaviors of individuals and to inform these individuals of their increased mortality risk associated with these behaviors. The component of the HEAR instrument designed to assess preventive care needs of TRICARE enrollees will be similar in design to many existing HRAs. However, the HEAR HRA will be used primarily by the primary care manager (PCM) in evaluating, treating, and referring the individual patient. A separate information sheet will be sent to the patient himself or herself; however, this is a secondary function for this Project HEAR objective.

In this section, we first introduce the subject of HRA by reviewing literature describing the origin and use of HRA, including implementation strategies. Next, specific HRAs are discussed, including national surveys, military programs, and the commonly-used Carter Center/CDC HRA. This demonstrates the current uses of HRA, including the types of information collected. We next review some of the information related to the use of HRA in primary care, pointing out some of the difficulties in implementing preventive strategies. Finally, the current basis for preventive services is discussed. This includes Healthy People 2000, the preventive health objectives for the U.S.; Put Prevention into Practice (PPIP), a government program for the implementation of preventive health services in primary care; and HEDIS measures, benchmarks used for evaluating patient outcomes in managed care settings.

A number of experts in HRA and in implementation of preventive services were interviewed, and their comments have been summarized. One expert, Dr. Donald Gemson, presented detailed recommendations regarding the implementation of PPIP. The reviewed literature and interviews were analyzed, discussing the difficulties in the use of HRA and PPIP. Finally, we present recommendations for the use of HRA in Project HEAR to collect information on preventive service needs from TRICARE enrollees.

A. Literature Examined

Unlike the other components of the HEAR instrument, there is little question as to the feasibility of identifying needed preventive services; most researchers would agree that preventive service needs of individuals can be identified using a self-reported questionnaire. Issues for this component focus instead on instrument design, program implementation, and overlap with national health care objectives such as those described in Healthy People 2000 and the HEDIS measures. Our literature review has, therefore, focused on these topics. This section reviews the available information describing the basis of HRA; standard methods of implementation; HRA in national surveys; and the role of recently-developed objectives, guidelines, and programs related to HRA and preventive health care.

1. Purpose and Uses of Health Risk Assessment

HRA was initially developed for health education purposes by assisting health providers in counseling patients to modify high-risk behaviors. The concept of HRA was developed by Robbins and Hall in the late 1950s. Since its inception, a wide variety of instruments have been

developed to assess participant health status and reinforce health-promoting behaviors in health care settings. Currently, HRA instruments have two primary uses. First, many health care settings are using HRAs to depict the general health status of their clients or employee populations. Second, HRAs have been employed as a means of warning individuals about their personal health risks and advocate a lifestyle modification program (Smith et al., 1993).

HRA evaluates an individual's health-related behaviors, habits, lifestyle, personal characteristics, and personal and family medical history. These behaviors are compared with epidemiologic and vital statistics in order to project the individual's risk of death or disease over a specified period of time, usually ten years. The projections are often represented in terms of "appraisal age," which is subsequently measured against an individual's chronological age. It is important to remember that HRA does not estimate an *individual's* risk of death or disease acquisition, rather, it describes the odds or likelihood of death occurring in a *population* with certain characteristics (Spasoff and McDowell, 1987).

HRA is mostly used with middle-class, middle-aged, white populations. This in large part reflects the limitations of the available epidemiologic data, i.e., much of which is based on middle-class, white populations (Society of Prospective Medicine, 1994).

HRA achieves four main objectives: (1) to motivate individuals to participate in health promotion and health education activities; (2) to enable health care professionals to integrate prevention into clinical practice settings; (3) to allow employers to summarize the major health problems and health risks among their work force in order to plan health promotion campaigns; and (4) to measure the general health of large populations to identify health risks for public health and health education programs (DeFriese & Fielding, 1990).

Data for HRA questionnaires can be self-reported or provided by a health professional. HRA consists of three main components:

1. An appraisal of personal risk factors based on self-reported measures provided by the patient. This is often supplemented by other findings such as laboratory tests, fitness levels, and blood pressure screening.
2. A quantitative assessment of individual's future risk of morbidity or mortality.
3. Educational messages or patient counseling enabling a patient to make specified behavioral changes.

HRA has adapted many tools from the field of epidemiology to assess the different probabilities of morbidity and mortality (Society of Prospective Medicine, 1994). The major difference between the HRA and epidemiologic approach to risk estimation is that epidemiologic predictive models generally derive estimates from a baseline "unexposed population" while HRA relies on data from the "general population." The algorithms used to calculate risk vary depending on the approach used in calculating risk factors. Individual risk relative to average risk is derived from vital statistics data, while composite risk factors use the "credit-debit" method developed by Robbins and Hall (Schoenbach et al., 1983). The former approach relies on a risk factor estimate associated with a single disease while the latter combines several risk factor values into a composite profile.

2. Implementation of HRAs

There are two basic types of implementation strategies that can be used with HRA: group and individual programs.

i) *Group Strategies*

Group strategies are intended for dissemination of HRAs to a large number of individuals within a limited time period. Three main group strategies include: Mandatory Group Implementation (MGI), Voluntary Group Implementation (VGI), and Blanket Group Implementation (BGI) (Society of Prospective Medicine, 1993).

- MGI is the most expensive but also the most effective implementation strategy when maximum participation is the main objective. The strategy relies on group meetings held *during work time*. A presentation is provided which describes the process and attendees fill out their questionnaires. Even though attendance at the meeting is mandatory the completion of the instrument is not since mandatory completion could create resentment and result in falsified data.
- VGI is identical to the MGI except that questionnaires are fill out and feed-back sessions are held on employees' own time instead of work time.
- BGI relies on the mass distribution of HRA forms with easily read instructions about the HRA process. Employees fill out forms on their own time and return them.

ii) *Individual Strategies*

These programs, which stress confidentiality, convenience, and personal intervention, are intended for individual use and require on-going feedback and analysis. The most commonly used strategies are Self Administered Implementation (SAI) and Point of Access Implementation (PAI).

- SAI methodologies allow respondents to control the entire HRA process. Respondents input their own data and immediately receive the results. This self-scoring system is easy to use and implement; the only resource needed is a computer with on-screen instructions.
- PAI, a highly individualized strategy designed to maximize the impact on each individual, involves a one-on-one intervention with each participant and also a feed-back session. PAI is usually implemented in an employee health or physician office.

There are obvious advantages and limitations to using the methods summarized above. The choice of instrument should depend on several factors, including the type of setting, the amount of funds and time available for HRA, and the importance of assuring confidentiality to participants.

3. Health risk assessment using national surveys

The instrument developed for Project HEAR will be completed by a broad range of enrollees. It is possible that this instrument will be used by TRICARE enrollees at other locations beside Region VI. We therefore examined national surveys which had been used for HRA, to discuss their functions, strengths, and weaknesses.

i) *History*

The Office of Disease Prevention and Health Promotion (ODPHP) of the US Department of Health and Human Services and the Centers for Disease Control (CDC) have become the primary loci in the federal government for research and evaluation of HRA instruments. The federal government has sponsored two major initiatives designed to improve HRA instruments. In 1980, the CDC began the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing surveillance program designed to estimate the prevalence of risk factors for the major causes of death in the U.S. The CDC has worked collaboratively with the Carter Center of Emory University to update its own version of HRA. The Carter Center and CDC developed national policy recommendations to the U.S. Surgeon General called in a report *Healthy People*. The project used the best available risk model for 41 leading causes of death. A computerized

version of this instrument, released in 1988, uses logistic regression estimation equations as the primary tool.

ii) *Behavioral Risk Factors Surveillance Survey (BRFSS)*

The BRFSS is the central component of federal and state activities designed to monitor progress toward achieving the health objectives of the year 2000. Various studies have been conducted to assess design issues (reliability and validity) of national surveys and surveillance systems, including the BRFSS, the Risk Factor Update Project (RFUP), and the Framingham Heart Study. Some studies have focused on specified risk factors (e.g., cardiovascular diseases) while others assessed the general measurement properties of the surveys. The reliability of the BRFSS questionnaire was assessed in a random sample of adults (n=122) and a separate sample of black and hispanic adults (n=200) in Massachusetts (Stein et al., 1993). The questionnaire was administered by telephone twice, 21 to 44 days apart. There were no statistically significant differences in demographic characteristics or risk factors between administration of the questionnaires. Blacks and hispanics tended to report education, employment, and income less consistently than whites. Reliability was generally high for behavioral risk factors. Consistency tended to be lower among hispanic respondents than among blacks or whites.

The validity of the BRFSS was further assessed by comparing cardiovascular risk behavior estimates between the BRFSS and the Stanford Five City Project (FCPS) (Jackson et al., 1992). The BRFSS and FCPS samples were drawn from the same four northern California communities and compared cardiovascular risk factors. The two surveys found comparable estimates for certain risk factors for coronary heart disease (CHD), including smoking, number

of cigarettes smoked per day, rate of ever being told one has high blood pressure, rate of prescription for blood pressure medication, compliance in taking medications, and mean total cholesterol. However, significant differences were found for other risk factors, such as mean body mass index and rate of obesity.

Data were analyzed from the 1982 Texas BRFSS by age and sex in order to design and implement strategies for risk reduction programs (Gottlieb et al., 1987). The results indicated that men were more likely than women to report heavy drinking (76 percent versus 62 percent) while persons in the Southeast related the lowest prevalence rates for alcohol. Men also reported more frequent drinking and driving (11 percent versus 3 percent), smoking (34 percent versus 27 percent), obesity (42 percent versus 32 percent), and not using seat belts (63 percent versus 58 percent) than women. Women were slightly more likely to report sedentary lifestyles (64 versus 60 percent) and eating to cope with stress (31 percent versus 15 percent) than men. Variations among states in the prevalence of obesity or sedentary lifestyle was not as marked as those with heavy drinkers. Hypertension prevalence rates were highest for those states in the Southeastern U.S.

4. Military HRA programs

A number of HRAs have been used and are currently being used within the military health care systems. Hatsell and Gaughan (1983) described several related HRA programs used in the Air Force. The Health Evaluation and Risk Tabulation (HEART) Program was designed to reduce the risk of cardiovascular disease in active duty personnel. The specific risk factors addressed were hypertension, smoking, elevated cholesterol, and obesity. Hypertensive participants were

referred to the base medical facility for clearance for further participation in HEART risk reduction activity. Those with mild to moderate hypertension were taught methods of weight reduction and salt restriction; they were invited to attend hypertension focus groups. Smoking cessation programs and a blood lipid reduction program were also available.

The HEART Information System (HIS), part of the risk identification and reduction system, was responsible for collection, storage, and display of risk factor data. Indicative personnel data was supplied by the Air Force Military Personnel Center and provided the basis for the initialization and maintenance of the HIS database. Minimal data collected at each screening included age, blood pressure, smoking (> 10 cigarettes daily), total cholesterol, high density lipoprotein (HDL), HDL/total cholesterol, height, and weight. Information was stored on the central site computer; all data entered into the HIS were edited prior to acceptance. The HIS provides an efficient means for estimating the effectiveness of risk factor intervention and was designed for use during the HEART test phase, as well as during Air Force wide implementation of primary prevention programs aimed at a variety of diseases.

The Framingham Age and Sex Specific Estimator was used to rank risk in the population. Results consisting of risk factor values and an interpretation of risk status were provided to each respondent. About 20% of respondents had a significantly elevated risk for cardiovascular disease. Cigarette smoking was the single risk factor that contributed most significantly to those Air Force personnel found to be eligible for risk factor reduction. On the four Air Force bases used for the program test, about 50% of all age groups were found to be smokers. About 16% of persons with elevated composite risk were found to have hypertension. About 33% of respondents over 35 years old had elevated serum cholesterol. It is significant that of those

personnel found to be at increased risk for cardiovascular disease, more than 90% participated in at least a portion of the risk reduction program. Air Force personnel are at no less risk for cardiovascular disease than the general U.S. population, suggesting that traditional screening methods applied to this relatively young population have not been effective in mitigating the significant liability that cardiovascular disease represents to the Air Force. Furthermore, it is unlikely that presently available screening methods are sensitive enough to detect those who will go on to develop cardiovascular disease 20 or 30 years hence.⁵

The Air Force Surgeon General's Coronary Artery Risk Evaluation (CARE) Package was developed using technical products tested in the HEART program. The CARE effort is a practitioner-patient oriented program using only existing resources within an established physical examination system. The CARE tables used to calculate risk have been modified from the tables used in the Framingham study (absolute risk from Framingham has been converted to relative risk in the CARE tables). The CARE risk profile can be calculated using age, gender, smoking status, systolic blood pressure, and total serum cholesterol value. CARE has as its focal interest the reduction of risk factors which are strongly predictive for a young, asymptomatic population.

The Army's "Fit to Win" Program centers on an HRA designed to evaluate an individual's lifestyle and health risks, and provide feedback to the individual. The HRA has 75 questions, covering physical activity, nutrition/diet, driving practices, alcohol use (the four CAGE questions), job/life satisfaction, social support, tobacco use, and time since prior use of preventive medical services. There is also a large cluster of questions dealing with mental health

problems. In addition, medical personnel add information on cholesterol level, fasting glucose, blood pressure, and ECG results.

Information from the HRA is entered by optical scanner or keyboard into a data base. The database runs on IBM-compatible computers in a DOS environment and uses a standard query language. The database can provide aggregate analysis of an individual's health status, longitudinal information on an individual (the database has been in use since 1985), and a daily risk referral report listing soldiers who may require preventive services.

Fitzpatrick and Shannon (1992) studied the Army's Health Risk Appraisal Program using an aviation brigade at Ft. Hood, Texas. The three comparison groups consisted of brigade nonflight personnel, Ft. Hood as a whole, and the U.S. Army as a whole (data were taken from the Department of the Army HRA summary statistics.) Health-risk factors are divided into 1) diet and weight, 2) exercise, 3) substance use, 4) risk-taking behavior, 5) stress, and 6) medical risks (high blood pressure, cholesterol level).

Overall, significantly fewer flight personnel exceeded weight standards compared to the study groups, with the difference most pronounced in the 26 to 39 year old group. There were no significant differences in participation in aerobic or strength exercise between flight personnel and the study groups.

Current cigarette smoking was significantly lower among aviation personnel than in the three comparison groups but smokeless tobacco use was significantly higher among aviation personnel. Aviation personnel reported significantly higher alcohol consumption than those in the for Ft.

Hood population, but only slightly higher figures than U.S. Army. Aviation personnel reported significantly higher levels of driving after drinking (40%) and riding with a driver who had been drinking (45%) compared to the Ft. Hood and the U.S. Army populations. But, the proportion of aircrew who stated they sometimes or rarely use seat belts when driving or riding was significantly lower.

Non-aviation personnel, compared to aviation personnel, were more likely to exhibit stress, twice as likely to contemplate suicide, twice as likely to have inadequate family support, and four times as likely to have trouble sleeping. The proportion of aviation personnel with a history of high blood pressure was significantly lower than all other comparison groups.

Because this study is based on subjective and recalled information, these data are subject to the usual problems and biases of questionnaires. A response bias is likely to occur because subjects were asked to admit to illegal behavior and a variety of other negative habits.

The Department of Defense (DoD) is planning to distribute a revised Annual Beneficiary Survey soon. This survey will be sent to a random sample of the more than 8 million individuals in the military health care system. The survey is based on health care received during the past 12 months and focuses on five areas: health status, access to care, satisfaction with health care, use of health care, and familiarity with health care services. The survey instrument was developed by the TriService Survey Working Group after reviewing Army and Air Force questionnaires, the 1984 and 1992 DoD Health Surveys, and civilian health care surveys. There are a total of 99 questions, requiring approximately 30 minutes to complete. Information from the survey will be used for policy analysis, evaluation, and regional planning. Results from the

survey will also form the basis of a report to Congress. While this survey is intended to have a number of functions, questions dealing with health status are similar to those from HRA instruments.

5. The Carter Center / CDC HRA

The HRA instrument developed by the Carter Center and later modified by the CDC is one of the most widely used forms. Responses to the questions from a sizable civilian population are available for comparison purposes. Questions from this instrument may therefore be appropriate to include in the Project heart questionnaire. A number of studies have examined the accuracy, reliability, and validity of this instrument. Foxman and Edington (1987) applied this HRA to data collected from the Tecumseh Community Health Study in 1959-60 to examine predicted versus actual 10-year mortality rates. The CDC instrument rates were more accurate than those of standardized age-gender-race tables over the 10 year period.

Smith et al. (1989) evaluated the reliability of four HRAs: the CDC Health Risk Appraisal; the Heart Test from Arizona Heart Institute; RISKO from the American Heart Association; and Determine Your Medical Age from Blue Cross/Blue Shield of New York. Each instrument requires a respondent to select categories that best describe personal habits, physiologic status, and medical history. Point values or weights associated with these categories are then combined to produce an overall measure of risk. In these HRAs, overall risk is summarized by either a heart attack risk scale (where higher values represent greater risk) or by appraised age. Reliability analyses were conducted by comparing the baseline scores for individual risk items, heart attack risk, and appraised age with the values chosen by the same respondent at follow-up.

Participants were generally very consistent in their reports of family history and smoking. The lowest agreement rates occurred for lifestyle factors such as diet, stress, and physical activity, which are subject to recall bias as well as significant change over short periods of time. Results indicate that despite this consistency, HRA risk scores can vary greatly from one instrument to another.

A later study (Smith et al., 1991) measured the validity of the same four HRAs. Three HRA total risk scores were computed for each respondent: 1) the score reported by respondent, 2) the risk score corrected for mathematical errors, and 3) the score calculated on the basis of blood pressure, cholesterol, and height and weight measurements taken by field technicians. The first of these scores doesn't apply to the CDC HRA, which is calculated by computer. Each of these three risk scores was then correlated with the log transformed probability estimates derived from the NHANES I Epidemiologic Follow-up Study (NHEFS).

The first analysis focused on five specific risk factors for coronary heart disease (CHD): cigarette smoking, relative weight, physical activity, blood pressure and cholesterol. There were sharp distinctions among the individual risk factors. The coefficients for cigarette smoking and relative weight were always 0.6 or greater for each of the instruments. None of the correlations for physical activity, blood pressure, or cholesterol were higher than 0.5. The HRA risk scores for these items accounted for less than 23% of the variance in the physiological measures. The smallest correlations were found for blood pressure and cholesterol.

The second analysis assessed the validity of HRA scores for heart attack risk and appraised age. The CDC HRA, which had the highest correlations between risk scores and actual risk

probability, is a computerized instrument that uses a more sophisticated scoring algorithm than the other HRA's and was the only one that provided probability estimates for CHD mortality over a 10-year period. Determining Your Medical Age had the next highest set of correlations; mathematical errors had an important role in the validity of this HRA. Correlations for Arizona HRA were next highest (0.52) and RISK0 had the smallest correlation (0.13).

6. HRA in primary care

As discussed in the introduction to this section, the primary goal for this component of Project HEAR is to provide PCMs with enrollees' preventive care needs. While HRA has traditionally been used to provide information to individuals completing the questionnaire, HRA is becoming increasingly common in primary health care settings. However, few studies exist regarding its effectiveness or its acceptability to primary care practitioners. In one study, 69 family practice patients completed HRA questionnaires that were later computer analyzed (Bartlett et al., 1983). Patients were telephoned three to five months later to assess the effectiveness of the HRA intervention on behavioral changes. Of the patients who were counseled to alter a specified behavior, 41.3 percent reported beginning an exercise program, 27.8 percent stopped smoking, 20 percent decreased their alcohol intake, 23.5 percent reduced their driving to under 10,000 miles annually, and 75 percent of the women started breast self examinations. Furthermore, patients reported little objection to the personal nature of the questions, the length of time to complete the questionnaire, or the cost of the HRA forms.

In a similar study, seven general practice offices participated in an HRA study of ischemic heart disease in men aged 40 - 59 (Wilson & Morrell, 1991). The purpose of the study was to assess

the feasibility and usefulness of the score as part of a CHD prevention program. A score for identifying men at high risk of CHD was developed from the British Regional Heart Study, using multivariate analysis of risk factors, including cigarette smoking, blood pressure, previous history of heart disease or diabetes, and genetic factors. Practitioners were able to use the score as a way to identify high risk groups for health education.

Several articles published as the proceedings of a conference on health status measurement appeared in a Supplement of Medical Care in 1992. These articles discuss the evolution of health status assessment measures, and the benefits and barriers to their use in various clinical settings. Wasson et al. (1992) address the difficulties of incorporating global function and quality of life assessment into a busy ambulatory practice with limited time for each patient encounter. These authors emphasize the importance of selecting measures that are easy to incorporate into a practice, and which are meaningful to the health care professional in determining diagnoses and making decisions regarding treatment. Wasson et al. compare the single item, pictorial, categorically scaled COOP Charts with the 32-item Mental Health Inventory (MHI) in terms of sensitivity, specificity and predictive value. They maintain that the single-item COOP Chart can, for example, rule out serious psychiatric illness and correctly assess acceptable mental health in at least 66% of patients. The authors recommend that only certain patient populations (e.g. frail elderly) at greater risk of functional decline be targeted for assessment, given the paucity of evidence that functional status measurement is positively correlated with improvement in outcome.

Given et al. (1977) describe the initial use of the Health Status Index (HSI) in family practice to profile patients' health status longitudinally. The HSI was used in a Michigan residency training

center with 21 residents and two GPs; the center managed over 1,000 patient visits per month in 1975. Completion rates were based on 2,674 patient visits. The resident/physician completed the HSI for all patients at each visit. He or she also indicated whether the problem was long- or short-term, and estimated the expected time to recovery of pre-visit health status for cases of acute illness, or expected status in three months for chronic illness.

Residents achieved HSI completion rates of approximately 87%, indicating good compliance with this procedure. The authors describe how the HSI can assist physicians in managing a practice more effectively by providing appropriate first and continuing care to patients, allocating resources available within a larger health care system, and describing the clinical course of most acute and chronic illness. The HSI identifies treatment modes that shorten duration of illness or reduce illness severity, and assists in determining health care costs associated with desired health outcomes.

Brazier et al. (1992) tested two HRAs in general practice, the short form 36-item health survey questionnaire (SF-36) and the Nottingham Health Profile (NHP). 1,980 patients aged 16 to 74 were randomly selected to receive the SF-36 or the NHP. The response rate was 83%. Missing data rates were lower for all dimensions of the SF-36 (0.5% - 4%) than for the NHP (4% - 7%) and were significantly associated with increasing age in three of the eight SF-36 dimensions. The SF-36 could be completed in five minutes. Results indicate that the NHP is not particularly well-suited for use in general practice and use of the SF-36 is more appropriate.

Another general practice (Dlugolecka and King, 1989) study used a 1-page form (Heart Disease - Are You at Risk?) to assess risk for coronary artery disease and facilitate discussion between

the practitioner and patient regarding risk reduction. Nine risk factors were grouped into three-item sections to cover major modifiable contributory factors (smoking, blood pressure and diet), secondary modifiable factors (stress, weight, exercise), and non-modifiable factors (age, gender, family history). Points were used to weight the responses. The physician and patient together determined the patient's global score and associated degree of risk, and the patient kept information regarding risk reduction. The objective was to introduce the topic in a non-threatening way and to encourage the patient to accept appropriate responsibility for healthy behavior.

7. Clinical Preventive Services

After collecting information to assess preventive care needs, PCMs must be able to make recommendations regarding appropriate preventive services. A number of barriers have historically existed in implementing clinical preventive services. This section discusses these barriers and recent policy guidelines which encourage the delivery of preventive care.

i) *Difficulties in the Implementation of Clinical Preventive Services*

Clinicians now have the opportunities, skills, and resources to prevent disease and promote health as well as to cure disease. Many of the most serious disorders encountered in clinical practice can be prevented or postponed by immunizations, chemoprophylaxis, and healthier lifestyles; they can be detected early with screening and treated effectively. Yet, the delivery of preventive care is far from satisfactory. For example, the vaccination rate of adults 65 and older against pneumococcal infections is only about 20 percent, and delivery rates are also low, often less than 50 percent, for other basic types of preventive care. There are several reasons for this,

including: lack of clinician time, which is often related to inadequate reimbursement; lack of clinician knowledge and interest; lack of patient involvement and knowledge; and lack of office or clinic systems to promote preventive care. Furthermore, clinicians report uncertainty concerning how and when clinical prevention services should be performed.

Part of the uncertainty among physicians stems from the multiple and sometimes conflicting sources of information concerning clinical preventive care. Recommendations are issued regularly by government health agencies, medical specialty organizations, professional and scientific organizations, voluntary associations, and individual experts. Clinicians may also be reluctant to perform preventive services because of skepticism regarding their clinical effectiveness; these uncertainties have raised questions about the value of routine health examinations for asymptomatic individuals.

Another major obstacle is posed by the lack of equity in the remuneration of practitioners engaged in disease prevention and health promotion activities, for instance, health professionals providing curative interventions on a fee-for-service basis (Gellert & Dillenberg, 1993).

Prevention activities in a primary care setting involve lengthy time commitments, counseling, patient education, and follow-up to promote behavioral change. These prevention activities to reduce high-risk behaviors are important to the U.S. population and to cost containment within the health care system, as is evidenced by the current morbidity and mortality patterns which indicate that most disease can be prevented.

ii) *Healthy People 2000*

Healthy People 2000 and related publications have attempted to address the issues associated with implementing clinical preventive services. The objectives outlined in *Healthy People 2000* form the cornerstone of the U.S. Public Health Service prevention initiatives for the year 2000. These objectives are broadly organized into four major categories: Health Promotion, Health Protection, Clinical Preventive Services, and System Improvement Priorities. *Healthy People 2000* defines three broad goals: to increase span of healthy life; to reduce health disparities; and to achieve access to preventive services for all (U.S. Dept. of Health and Human Services, 1993).

Healthy People 2000 adopted the "management-by-objectives" planning process common in the business world. This process emphasizes prevention of disability and morbidity; improving the health status of definable population groups at highest risk of premature death, disease and disability; and including more screening interventions to detect asymptomatic diseases and conditions sufficiently early to prevent premature mortality and disability.

A series of reports during the 1970s and early 1980s introduced a set of guidelines for prevention in primary care but discrepancies in recommendations and standards contributed to uncertainty relating to instituting prevention measures. In 1989, the dissemination of the U.S. Preventive Services Task Force (USPSTF) report entitled *Guide to Clinical Preventive Services* marked the first U.S. government initiative with specific guidelines for clinical preventive services placing particular emphasis on the value of patient counseling (U.S. Dept. of Health and Human Services, 1989). This guide was later used in developing clinician recommendations for the Put Prevention into Practice (PPIP) program.

iii) *Put Prevention Into Practice (PPIP)*

Although the *Healthy People 2000* objectives emphasize the importance of preventive care services, they do not provide specific guidelines concerning implementation. It provides little guidance on the methods by which medical schools, residency training programs, and continuing medical education can effectively disseminate the recommendations in the USPSTF Report. For the past two years, the Office of Disease Prevention and Health Promotion (ODPHP), in cooperation with major health-related voluntary groups, provider organizations, and other U.S. Public Health Service agencies, has developed the PPIP initiative. PPIP is one of the three major components of the national health promotion and disease prevention objectives for the year 2000. The goal of the PPIP program is to improve the delivery of clinical preventive services, including immunizations, screening tests, and counseling interventions for both adults and children. It is targeted toward health care providers (physicians, nurses, nurse-practitioners, physician assistants), patients, and office and clinic staff. All previous prevention campaigns had focused on specific services or diseases, or emphasized a particular age group or gender. This program is the first broad based initiative covering all major preventive services.

PPIP gives health care providers, patients, and office systems/staff guidance in performing a broad range of clinical preventive services.

- *The Clinicians Handbook of Preventive Services* provides simple, authoritative information on preventive care. The book summarizes sometimes discrepant recommendations about the use and timing of various screening tests and offers recommendations from the U.S. Preventive Services Task Force.
- Educational materials for patients, including a "Personal Health Guide" for adults, and a "Child Health Guide," along with educational wall posters.
- A series of office tools for providers and for patients.

- For providers, "flow sheets" designed to summarize the need for and delivery of preventive services in patient charts as well as "alert" stickers and "Post-It" notes to remind busy clinicians to ask their patients about various risk factors;
- For patients, reminder post-cards to remind them of follow-up visits and Prevention Prescription Pads to remind patients about specific actions that they should undertake.

Studies have demonstrated that with appropriate training and office systems support, physicians and other health care providers can improve their prevention effectiveness. Paper-based reminder systems (e.g., flow charts, reminder notes, patient mini-records) have proved particularly effective in increasing physicians' prevention advice.

The PPIP materials are based on interventions tested through focus group discussions with providers, office staff, and patients. A major pilot test of PPIP materials was conducted at two inner-city municipal hospitals in New York City: Harlem Hospital serving as the intervention site and Kings County Hospital as the comparison site (Gemson et al., 1993). The study was designed to evaluate a model for dissemination of prevention practice guidelines that is practicable, feasible, and generalizable to other settings. The major objective of the study was to test the impact of PPIP materials on preventive services. The intervention site received a six-month supply of printed materials with a series of prevention lectures and seminars. The study included all eligible resident and attending physicians in the Department of Medicine at both hospitals, with a participation rate of 96 percent. Patients were selected from the medical clinics, with a response rate of 90 percent at time 1 interviews and 84 percent at time 2. The intervention consisted of two main components: PPIP printed materials for physicians and patients, in the health care setting; and prevention lectures and seminars.

To supplement the physician counseling on prevention, patients were queried concerning physician preventive services. The intervention was multi-dimensional, relying on a variety of techniques to reinforce the written materials and seminars (i.e., prevention posters, banners, and literature in the medical clinic). Results of the PPIP study demonstrate statistically significant differences between the intervention and control sites with regard to changes in preventive services reported by providers and patients. The results revealed a consistent increase in every major category of self-reported prevention practices by physicians at the intervention site when compared to the control site. A follow-up survey to assess changes among patients was not performed.

8. Health Plan Employer Data Information Set (HEDIS)

HEDIS measures are a more recent development which will further encourage the delivery of preventive care services. A core set of measures was released in November 1993 by the National Committee for Quality Assurance. HEDIS consists of a set of health plan performance measures which are presently being developed and pilot tested in several HMOs around the country. The cornerstone of HEDIS is the creation of standardized measures that document health plan performance in various areas of health care delivery (Corrigan and Nielsen, 1993). Selection of specific measures for inclusion in HEDIS was based on three criteria: (1) relevance and value to the employer community, (2) reasonable ability of health plans to develop and provide the requested data in the specified manner, and (3) potential impact on improving patient care and reducing morbidity and mortality. One of the most important aspects of HEDIS, aside from defining a core set of performance measures, is its efforts to systematize the measurement process. By recommending standard definitions and specific methods for deriving

performance measures, HEDIS can be generalized to various settings in a comparable manner. The four main categories addressed by the HEDIS measures are preventive services, prenatal care, acute and chronic illness, and mental health. For each performance measure (e.g, childhood immunization rate) there are five major components:

- a background section explains the rationale for selection of the measure and, when available, delineates national goals for performance achievement included in the *Healthy People 2000* objectives
- a general description of the performance measure
- specifications for deriving the measure from administrative data
- specifications for deriving the measure through conduct of a medical record review
- a list of references

Many of the measures address important public health priorities identified in the *Healthy People 2000* objectives. To minimize the effects of population differences, most of the recommended performance measures assess discrete aspects of the process of health care delivery (e.g., percentage of pregnant women with first-trimester visits) rather than outcomes.

Summary of HRA Studies

Source	Purpose	Findings
HRA-National Surveys Gottlieb et al., 1987	To compare risk behaviors of the Texas BRFSS by age, sex, and geographic regions.	<p>Men were more likely to report the following high risk behaviors, including: drinking, driving and driving, smoking, obesity and not using seat belts; while <u>women</u> reported higher: sedentary lifestyles, and eating to cope with stress. Variations were also noted among <u>geographic areas</u>: persons in the Southeast had the lowest prevalence rates of heavy drinking, but the highest rates for hypertension. Differences among states for obesity or sedentary lifestyle were not as marked.</p>
Jackson et al., 1992	To compare the reliability of the BRFSS and FCPS in predicting cardiovascular risk factors.	<p>Comparable estimates for certain risk factors for CHD were found (i.e., smoking, number of cigarettes smoked per day, high blood pressure, etc.) Significant differences were found for other risk factors such as mean body mass index and rates of obesity.</p>
Stein et al., 1993	To assess the reliability of the BRFSS questionnaire in a sample of adults and separate sample of black and hispanic adults.	<p>No statistically significant differences in demographic characteristics or risk factors were detected between two administrations of the questionnaire. Blacks and Hispanics tended to report less consistently: education, employment, and income. Consistency was lower among Hispanics than among Blacks or Whites for all categories.</p>

Summary of HRA Studies (continued)

Source	Purpose	Findings
HRA in Primary Care Bartlett et al., 1983	To assess the effectiveness and acceptability of HRA in a primary care setting.	HRA instruments were found to be effective tools for high risk behavior reduction. Following patient counseling the following behaviors were modified: exercising, smoking, alcohol intake, driving, and BSE for women. Patients also reported little objection to the HRA questionnaire.
Brazier et al., 1992	To compare the use of the SF-36 and the Nottingham Health Profile (NHP) in general practice.	The SF-36 is more appropriate for general practice than the NHP due to the lower levels of missing data and the minimal time (approximately 5 minutes) required to complete the form.
Given et al., 1977	To evaluate the use of the Health Status Index (HSI) in family practice.	HSI completed by residents or physicians for 87% of patient visits, indicating good compliance. The study suggests that the HSI can be used to manage primary care more efficiently.
Wilson & Morrell, 1991	To evaluate the feasibility and usefulness of HRA as part of CHD program.	Health care professionals were able to develop a composite score for measuring ischemic heart disease in middle aged men. This score is used to identify high risk groups for health education.

Summary of HRA Studies (continued)

Source	Purpose	Findings
Military HRA Programs Fitzpatrick & Shannon, 1992	To assess the applicability of the Army's HRA program using an aviation brigade in Texas.	<p>Major differences between aviation personnel and 3 comparison groups were found. Significantly fewer flight personnel exceeded weight standards, reported substance abuse problem, and smoked. Aviation personnel reported higher alcohol consumption, drinking and driving, and riding with a driver who had been drinking. Non-aviation personnel were more likely to exhibit stress, contemplate suicide, have inadequate family support, and report sleep disturbances.</p>
Hatsell & Gaughan, 1983	The HEART program was designed to reduce the risk of CHD in active military personnel and compare the risk factors to the general population.	<p>It was found that Air Force personnel are not less at risk for CHD than the general U.S. population, suggesting that traditional screening methods have not been effective in decreasing the likelihood of CHD occurrence.</p>

Summary of HKA Studies (continued)

Source	Purpose	Findings
<p>Carter Center/CDC HRA</p> <p>Foxman and Edington, 1987</p> <p>Smith et al., 1989</p> <p>Smith et al. 1991</p>	<p>To assess the accuracy, validity, and reliability of the instrument.</p> <p>To evaluate the reliability of four HRAs (CDC Health Risk Appraisal, the Heart Test from Arizona Heart Institute, RISCO from American Heart Association, and Determine Your Medical Age from Blue Cross/Blue Shield).</p> <p>To measure the validity of the same four HRAs mentioned above for CHD.</p>	<p>Using data collected from the Tecumseh Community Health Study the CDC instrument rates were more accurate than those of standardized age-gender-race tables over a ten year period.</p> <p>Participants consistently reported family history and smoking. Relative weight was accurately reported 70% of the time. The lowest agreement rates occurred for lifestyle factors such as: diet, stress, and physical activity.</p> <p>Strong distinctions were found for individual risk factors. The coefficients for cigarette smoking and relative weight were above .6. The coefficients for physical activity, blood pressure, and cholesterol were less than .5. The HRA risk scores for these items accounted for less than 23% of the variance in the physiological measures.</p>

Table 2
HEDIS Measures

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Preventive Services:			
Childhood Immunization	Increase immunization levels as follows: Basic immunization series among children under age 2: at least 90 percent. (Baseline: 70-80% estimated in 1989).	<p>DPT - at 2, 4, and 6 months, with booster between 15 and 18 months.*</p> <p>OPV - at 2, 4, and 6 months, with booster between 15 and 18 months.*</p> <p>MMR - at 15 months.**</p> <p>H influenza type B - at various ages beginning at 2-6 months with a total of three or four doses given prior to two years of age.</p>	<p>This specification uses a sampling of outpatient medical records. <i>In HMOs, the measure should be computed for direct pay/group enrolled members only.</i></p> <p>Denominator: A random sample of "N" children drawn from all health plan enrollees whose second birthday is in the reporting period (i.e., most recent calendar year) AND who were continuously enrolled from 42 days of age. "N" is determined by following the "Sampling Guidelines" (see Appendix III).</p> <p>Numerator: The number of children in that group who have</p> <ul style="list-style-type: none"> ▪ at least four DPT (code 90701) with different dates of service by age two, and ▪ at least three OPV (code 90712 or 90713) with different dates of service by age two, and ▪ at least one MMR (code 90707) or at least one measles (codes 90705 or 90707 or 90709) one mumps (codes 90704 or 90707 or 90708) and one rubella (codes 90706 or 90707 or 90908) with dates of service falling between the child's first and second birthdays, and ▪ one H influenza type B (code 90737) with dates of service falling between the child's first and second birthdays.

HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Cholesterol Screening	Increase to at least 75% the proportion of adults who have had their blood cholesterol checked within the preceding five years. (baseline: 50% of people aged 18 and older had "ever" had their cholesterol checked in 1988; 52% were checked "within the preceding two years" in 1988)	All persons aged 20 and above have a cholesterol determination at least once every five years. (National Heart, Lung, and Blood Institute).	<p>Calculation of the Measure: This specification uses a review of a sample of charts of members to determine the cholesterol screening rate. <i>In HMOs, the measure should be computed for direct pay/group enrolled members only.</i> Following are the instructions for calculating the cholesterol screening rate for the 40-64 age group. To calculate the rate for the 20-39 age group, follow the same instructions, just substitute 25-39 for 40-64. For the younger age group, the measure assesses 25-39 year olds rather than 20-39 year olds because age is defined at the end of the five-year screening interval and includes only members who met the age criteria for screening throughout the measurement period.</p> <p>Denominator: A random sample of "N" enrollees drawn from a health plan's eligible population forms the denominator of this measure. "N" is determined by following the "Sample Guidelines" (see Appendix III). Enrollees will be members aged 40-64, continuously enrolled for the prior two-year period. Enrollees are "aged 40-64" if they are 40 years or older, but not yet 65 years as of 12/31 of the reporting period (i.e., most recent calendar year).</p> <p>Numerator: The number of enrollees whose sampled records contain documentation of cholesterol screening during the prior five-year period. Cholesterol screening is documented by presence of provider notes and/or laboratory reports in the chart, providing evidence of cholesterol/lipid profile completed by either a plan provider or an out-of-plan provider. A cholesterol determination is documented if a submitted claim/encounter/laboratory record includes one of the following codes or groups of codes:</p> <ul style="list-style-type: none"> ■ CPT-4 82465 - cholesterol, serum, total; or ■ CPT-4 83718 - Lipoprotein, direct measurement; high-density cholesterol and; ■ CPT-4 83719 - VLDL cholesterol and; ■ CPT-4 83721 - LDL cholesterol or; ■ CPT-4 80061 - Lipid profile or; ■ CPT-4 80002-80019 - Automated, multichannel tests <p>Note: Multichannel test may be counted only if one or more of the tests includes a cholesterol or lipid profile.</p>

HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Mammography Screening	Increase to 80% the proportion of women aged 40 and older who ever received a clinical breast examination and a mammogram, and to at least 60% those aged 50 and older who received them within the preceding 1-2 years. (Baseline: 36% of women aged 40 and older "ever in 1987; 25% of women aged 50 and older "within the preceding two years" in 1987).	Performed after age 50 at one-to-two year intervals and concluded at approximately age 75 unless pathology is detected. (US Preventive Services Task Force).	<p>Calculation of the Measures: The measure uses as the denominator an examination of a sampling of charts of women aged 52-64 continuously enrolled during the preceding two calendar years and as the numerator the number of those women who received one or more mammograms during the prior two years. The result is presented as a percentage. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: A random sample of "N" individuals drawn from a health plan's eligible population forms the denominator of this measure. "N" is determined by following the "Sampling Guidelines" (see Appendix III). Eligible members will be women aged 52 to 63 as of December 31 of the reporting period (i.e., most recent calendar year) and continuously enrolled during the preceding two years.</p> <p>Numerator: The number of individuals whose sampled records contain documentation of a mammogram having been performed during the two-year period. The number of women defined by the denominator who had one (or more) mammogram(s) during the previous two calendar years. A woman is counted as having had a mammogram if a submitted claim/encounter meets any of the following or equivalent criteria:</p> <ul style="list-style-type: none"> ▪ CPT-4 code 76090, 76091 or 76092, ▪ Revenue code 401 or 403 ▪ ICD-9 procedure codes 87.37 or 87.36, or ▪ Revenue code 320 or 400 in conjunction with a breast-related ICD-9 diagnosis code.

HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Pap Smears for Cervical Cancer Screening	Increase to at least 95% the proportion of women aged 18 and older with uterine cervix who have ever received a Pap test and to at least 85% those who receive a Pap test within the preceding 1-3 years. (Baseline: 88% "ever" and 75% "within the preceding three years" in 1987).	Annual Pap smears for all women who are or have been sexually active or have reached age 18. If three or more annual Pap smears have been normal, the interval may be increased from one year to three years at a physician's discretion. If Pap smears have been normal, testing may be discontinued after age 65. (American College of Obstetricians and Gynecologists, American Medical Association, American Cancer Society).	<p>Calculation of the Measures: The measure employs the review of a sample of charts of women aged 21-64 who were continuously enrolled during the preceding three-year period to ascertain whether a Pap test was taken during the preceding three years. The result is presented as a percentage. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: A random sample of "N" members drawn from a health plan's eligible population forms the denominator of this measure. "N" is determined by following the "Sampling Guidelines" (see Appendix III). Eligible members will be women aged 21-64 as of 12/31 of the reporting period (i.e., most recent calendar year) and continuously enrolled during the prior three-year period.</p> <p>Numerator: The number of women in the sample who received one or more Pap tests during the preceding three calendar years. A woman is identified as having a Pap test if she has a claim/encounter that meets one of the following criteria:</p> <ul style="list-style-type: none"> ■ CPT-4 code 88150, 88151, 88155, 88156 or 88157. ■ Revenue code 923, ■ Revenue code 300 or 310 in conjunction with a cervical-related ICD-9 diagnosis code, or ■ ICD-9 procedure code 91.46.

HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Low Birthweight	Reduce low birthweight to no more than 5% of live births and very low birthweight to no more than 1% of live births. (Baseline: 6.9% and 1.2% respectively, in 1987).		<p>Calculation of the measures: The measure employs the use of administrative data (e.g., hospital discharge abstract data) and/or birth certificate data. Hospital discharge data and/or birth certificate data identify which of the live births have birthweights less than 1,500 grams and/or less than 2,500 grams within health plan for a calendar year. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: Eligible members will be mothers aged 10-49 as of 12/31 of the reporting period (i.e., most recent calendar year) and continuously enrolled for 12 months prior to delivery.</p> <p>Numerator: The number of births, reflect in the denominator, with birthweights of less than 1,500 grams. The numerator for calculating the low birthweight rate is the number of these births, with birthweights of less than 2,500 grams.</p>
Prenatal Care in First Trimester	Increase to at least 90% the proportion of all women who receive prenatal care in the first trimester of pregnancy. (Baseline: 76% of live births in 1987).		<p>Calculation of the measures: The measure is based on hospital discharge abstract data and ambulatory encounter data. Women who had a live birth and who were continuously enrolled for 12 months prior to delivery, are eligible. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: All women continuously enrolled for 12 months prior to delivery and resulted in live births are identified as women discharged with a principle or secondary ICD-9 diagnosis code of: 640-648.9 with fifth digit equal to "1" or "2" 651-676.9 with a fifth digit equal to "1" or "2" 650.xx 669.5x-669.7x V codes of 27.0, 27.2, 27.3, 27.5, or 27.6.</p> <p>Numerator: The number of women in the denominator population who had an obstetrical visit 26-44 weeks prior to delivery (or prior to estimated date of confinement, if known). Note that the numerator is calculated retroactively from time of delivery.</p>

Table 2
HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Asthma Inpatient Admission Rate	Reduce asthma morbidity, as measured by a reduction in asthma hospitalizations, to no more than 160 per 100,000 people. (Baseline: 188 per 100,000 in 1987). Reduce to no more than 10% the proportion of people with asthma whose experience activity limitation. (Baseline: average of 19.4% during 1986-88).		<p>Calculation of the Measure: Although two methods are used to calculate this performance measure, the PAC recommends that all health plans calculate the measure using Method 1. Health plans with access to the data necessary to follow Method 2 (prescription drug data), should use Method 2 and in addition to Method 1. Separate rates should be calculated for members aged 1-19 yrs and 20-39 yrs. For Method 1, the population-at-risk (the denominator) consist of all enrollees within a give age range. For Method 2, the population-at-risk includes enrollees within a given age range who are actively being treated for asthma, which has more sensitivity. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: Method 1 The number of members aged 2-19 yrs as of 12/31 of the reporting period (i.e. most recent calendar year) continuously enrolled during the prior 12 month period. Method 2 The number of members aged 2-19 yrs. as of 12/31 of the reporting period (i.e. most recent calendar year) continuously enrolled during the prior 12 month period and who have been dispensed bronchodilator (beta adrenergic or anticholinergic), theophylline, cromolyn sodium and/or aerosol corticosteroid during the year on an ambulatory basis.</p> <p>Numerator: Method 1 and 2 The number of members in the denominator (A/B) with one or more inpatient admissions for treatment of asthma. (Admission) Method 1 and 2 The number of members in the denominator (A/B) with two or more inpatient admissions for treatment of asthma. (Readmission)</p> <p>1/A or B the proportion of enrollees have at least one admission for asthma. 2/A or B the proportion of enrollees having more than one admission for asthma. 3/A the ratio of enrollees admitted more than once over enrollees admitted at least once. 3/B the ratio of asthmatics admitted more than once over enrollees admitted at least once.</p>

HEDIS Measures (continued)

Performance Measures	Healthy People 2000 Objective	Recommendations	Calculation of Measures
Diabetic Retinal Exam	Reduce the most severe complications of diabetes as follows: blindness 1.4/1000, baseline 2.2/1000.	The American Diabetes Association (ADA) recommends an annual eye evaluation from the time of diagnosis in patients who are older than age 30 and after five years of diabetes in patients aged 12 - 30 years.	<p>Calculation of Measures: This measure employs ambulatory pharmacy data to identify diabetics and ambulatory claims/encounter data to identify those who received an annual eye exam. <i>In HMOs, the measure applies to direct pay/group enrolled members only.</i></p> <p>Denominator: The number of members aged 31-64 years as of 12/31 of the reporting period (i.e. the most recent calendar year) continuously enrolled during the prior 12 month period and dispensed insulin or oral hypoglycemic during the reporting period on an ambulatory basis.</p> <p>ICD-9 250.xx Diabetes mellitus ICD-9 357.2x with 250.xx Polyneuropathy in diabetes ICD-9 362.0x 362.2x Diabetic retinopathy ICD-9 366.41 Diabetic cataract</p> <p>Numerator: Of person in the denominator, the number with a retinal/dilated ophthalmoscopic examination performed during the reporting period.</p> <p>CPT-4 92002 Ophthalmic services, intermediate, new patient CPT-4 92004 Ophthalmic services, comprehensive, new patient CPT-4 92012 Ophthalmic services, intermediate, established patient CPT-4 92014 Ophthalmic services, comprehensive, established patient CPT-4 92018 Ophthalmic services, general anesthesia, complete CPT-4 92019 Ophthalmic services, general anesthesia, limited CPT-4 92225 Ophthalmic services, extended, initial CPT-4 92226 Ophthalmic services, extended, subsequent</p>

* = CDC and US Preventive Services Task Force.

** = American Academy of Pediatrics.

B. Interviews with selected experts

1. Carol Furgal, Lovelace Health Clinic (LHC), Albuquerque, New Mexico, and Senior Consultant National Committee of Quality Assurance (NCQA)

Ms. Furgal stated that the objective of HEDIS was to develop a set of core health performance measures that could be used in every health plan. These performance measures were designed to allow purchasers to compare quality and cost of different HMOs. Presently, 12 to 20 HMOs including Lovelace are involved in the pilot phase of data collection for the HEDIS measures.

One of the problems encountered at LHC was that their three computerized databases (inpatient, ambulatory, and subscribers files) were not linked. Thus, first task was to link the three data systems. Another problem often encountered in managed care settings which do not have the fee-for-service system was that health care providers did not use the correct Current Practice Terminology (CPT) codes for services provided.

It is important to consider the following in order to effectively implement the HEDIS system:

- Use a tight system of control on office and clinician staff, especially regarding patient referrals
- Set up an aggressively managed HMO
- Place physicians in key administrative positions so they can act as a "mediators" between hospital staff and clinicians

2. Dr. Donald Gemson, Harlem Hospital, New York City

Dr. Gemson is the director of the PPIP initiative at Harlem Hospital. He made the following recommendations for disseminating prevention guidelines to practicing physicians based on the results of this study and the experience of the investigators in designing, implementing, and evaluating the PPIP project. They are not meant to be exhaustive but are intended to provide general guidelines for the dissemination of prevention information to clinicians that would be applicable in a wide variety of settings.

- 1) Programs should be rooted in a theoretical framework

A sound theoretical framework organizes the overall approach of the program and helps ensure that key components are included. For example, by identifying

predisposing, enabling, and reinforcing factors in a given setting, planners are more likely to address all of the fundamental issues in developing an intervention.

2) Identify and recruit opinion leaders

Every organization has certain individuals who are in a position to help a program function effectively. They can also assist in persuading individuals who may be resistant to the intervention to participate in the program. Planners should identify and recruit such individuals within their organization early in the process.

3) Form a planning committee with broad representation

In addition to recruiting "opinion leaders", representation from each segment of the workforce can be an invaluable part of the planning process. Inclusion of employees with different perspectives on the planning committee not only helps inform the process but also helps assure broad-based support of the program.

4) Use multiple channels of communication

Continuing medical education traditionally presents information through formal didactic sessions, an approach that may be necessary but not sufficient to influence practitioners' clinical behaviors. By utilizing multiple communication channels (e.g., posters, handbooks, wall charts, seminars, lectures), planners are more likely to reach a greater proportion of the target population and to effectively reinforce the educational message.

5) Focus on office-based resources

Research has demonstrated the effectiveness of a variety of office-based resources in the delivery of preventive services. Planners should carefully select resources appropriate to their budget, staff, and patient population. Although sophisticated computer reminder systems can be effective, inexpensive paper-based materials such as those in the PPIP program can be effective as well.

6) Incorporate didactic sessions

In their zeal to utilize office-based resources, some planners may overlook the importance of the communication of substantive information through didactic sessions. Clinicians should be informed of the clinical rationale for preventive services so that they feel intellectually comfortable with the scientific basis for preventive services. Didactic sessions can also address physicians self-efficacy by focusing on the potential of clinicians to promote health and prevent disease through the delivery of effective preventive services.

7) Involve office staff

Office staff should be included in program planning and implementation and should be encouraged to feel part of the program. Office staff can play critical roles in successful implementation by alerting patients to program messages, maintaining availability and display of materials, working with clinical staff in program implementation, and assisting in the scheduling of follow-up visits or preventive tests and procedures.

8) Provide training in use of office-based resources

Implementation of new resources in an office setting must be accompanied by orientation and training of staff. Training can address rationale for implementation, appropriate use of materials, practical issues in implementation, and the importance of follow-up and evaluation.

9) Involve patients

One of the barriers to implementation of preventive services cited by physicians is lack of patient interest. Patient involvement can be stimulated through appropriate use of intervention materials (e.g., the prevention passport in the Harlem study), placing of prevention-oriented banners and posters in waiting areas and exam rooms, support and involvement of office staff, and counseling by clinical staff about the importance of health promotion and disease prevention.

10) Evaluate

Evaluation can and should be undertaken in every setting in which a program has been initiated. Evaluation need not be technical and complex. It can involve review of program components at staff meetings or periodic interviews or written evaluations by patients and staff about the program. Program planners should be prepared from the outset to continually modify the intervention based on patient and staff feedback, changes in scientific recommendations, or availability of new or improved resources.

3. Lieutenant Colonel Mary Sanders, Naval Health Science and Education Training Command

Lt. Col. Sanders said that the Army and Air Force are currently using the Carter Center *Healthier People* HRA instrument. The Carter Center of Emory University began developing a probability-based adult health-risk appraisal instrument for the public domain in 1986. The Carter Center HRA computes health risk based on a 45 item questionnaire; twenty-nine of

these questions are used directly for computation of risk. The main reason the armed services have adopted this instrument is because it is a public domain HRA and, therefore, involves no cost in purchasing the instrument or the computer program which is used to analyze individuals' risk. The Army is using the core version of the Carter Center HRA but has added 12 supplemental questions related to mental health.

4. Dr. Bruce Bruck, Information Transfer Systems, Ann Arbor, Michigan

Dr. Bruck is director of Information Transfer Systems, a firm working in the area of worksite wellness; they also perform survey and evaluation research with a focus on health status and risk factors. Dr. Bruck has been involved with the National Center for Health Statistics (NCHS) in the effort to continue *Health People 2000* objectives for assessing community health at the federal, state, and local level. This assessment has two components: community health status indicators, which are largely standard mortality and morbidity indicators; and priority data needs, which are health-related topics for which information is generally not available at the local level. Information Transfer Systems (ITS) has a contract with NCHS to pilot test measures for assessing areas of priority data needs. As part of this task, ITS is developing a computerized database of questions from national surveys involving these priority areas.

ITS has also developed worksite wellness programs for corporations. Dr. Bruck is currently involved in integrating these wellness programs into overall corporate health and medical planning. The goal is to have health risk assessment and initial intervention occur during a single session, when each employee enters the company's health care system. The health risk assessment attempts to identify high risk individuals, focusing on smoking, obesity, cholesterol,

and alcohol. Approximately 60% of the work-force has at least one of these risk factors. Prior medical utilization information is also used to identify a subset of individuals which is likely to continue to be high utilizers.

Dr. Bruck stressed using items that are based on the design of such questions in national surveys to assess risk factors. This will allow for increased reliability and increased comparison opportunities. Further, this assessment will require an organized information system with an appropriate infrastructure for tracking, intervention, and analysis. The interventions based on results from the developed instrument should utilize one-on-one counseling; interventions which only provide patient educational material have not been shown to be effective.

5. Major Sandra Goins, U.S. Army Health Care Systems Support Activity, San Antonio, Texas

Major Goins is the Health Risk Appraisal/CVS Project Officer. The Army's HRA, which was started in 1985 and updated in 1987, involves 75 questions on health risks and personal information. Respondents receive an individualized report for current age, risk age, and achievable age. Data from the questionnaire is stored in a database; no other information, beyond the questionnaire data, is stored in this data base. The program was initially based on the Rhode Island Wellness Program and was later updated using the Carter Center/CDC HRA. The Army staff is starting to modify questions on the HRA for use in all branches of the military.

6. Dr. Betsy Foxman, The University of Michigan, Ann Arbor Michigan

Dr. Foxman is on the faculty of the Department of Epidemiology at The University of Michigan and has done work on the accuracy of HRA. She stated that HRAs tend to get very vague information which is primarily used to counsel respondents regarding lifestyle changes. The type of information typically collected by HRAs may not be useful for indicating patient preventive service needs to a PCM except for counselling. However, many PCMs may not have sufficient time to perform counselling. Therefore, the intervention that is to arise from the HRA results must be considered in designing an HRA. For example, if the objective is to counsel a patient regarding lifestyle, who will be doing the counselling? Results for individual HRAs being sent to PCMs must also be made relevant and supplied in an abbreviated form.

HRAs tend to focus on cardiovascular disease risks. The addition of questions related to injury and accident prevention will be very useful for reducing morbidity and mortality. To make an instrument more useful for future applications, questions regarding genetics and family history also should be included.

C. Literature and Interview Analysis

Health risk assessments have traditionally been used to analyze the increased risk of morbidity or mortality for individuals based on their sociodemographic, behavioral, and clinical characteristics. HRA has numerous desirable features for clinicians and health educators such as its preventive orientation, systematic approach, and emphasis on behavior modification.

HRA is a relatively inexpensive and unobtrusive way to measure risk and subsequently counsel

patients to modify high risk behaviors. Studies show that HRAs can successfully be used in primary care settings. However, care must be used when employing HRAs to specific sub-populations such as the young or the elderly, to persons from lower socio-economic levels; or to non-white populations, as the accuracy of HRAs in these populations has often not been documented.

HRA has been performed on a national level using the BRFSS. While many items used in the BRFSS have been reported to be reliable and valid, it may have limited utility in meeting public health needs for some risk factors, such as those related to weight, due to low test validity. Further, the reliability of BRFSS questions has been assessed through test-retest procedures, which may suffer from a number of methodologic problems. Despite these difficulties, studies using data from the BRFSS indicate that the prevalence of most behavioral risk factors vary substantially among states, by gender, and by age. These studies suggest that race, gender, and geographic diversity are important factors to consider when implementing a population-based prevention program.

A number of HRA instruments, such as the CDC HRA, have been examined in terms of validity and reliability. Results indicate that self-reported risk scores for cigarette smoking appear to be reasonably accurate. Reports for physical activity, blood pressure, and cholesterol were inaccurate when compared to objective measures. The validity of clinical measures such as blood pressure and cholesterol levels can be increased by measuring these values during physical exams rather than relying on self-reports.

Two sources of error were noted in determining HRA total risk scores: 1) respondents may be unaware of the appropriate values for physiological measures, and 2) computational mistakes made by respondents. Computation errors may severely reduce the reliability of self-scored instruments. Computerized HRAs (like the CDC HRA) may therefore be the most desirable type unless manual calculations can be routinely checked for errors.

In addition to the traditional functions of HRA, it is clear that needed preventive services and counselling interventions can also be identified using health risk assessment. With the growing interest in managed care throughout the U.S., leaders in the health arena have advocated improved provision of preventive as well as curative services. Many diseases can be prevented or postponed by preventive clinical services or by appropriate patient responses to counselling (e.g., changes in lifestyle). This implies that preventive services are as vital to a health setting as curatives activities.

However, clinicians may be reluctant to offer clinical preventive services for a number of reasons. One major reasons is the lack of financial reimbursement for preventive care services. The current practice of dismissing preventive services in favor of curative activities will only result in short-term economic and access benefits. Managed care settings will be increasingly successful if they establish incentives for practitioners providing preventive care services.

Other barriers to the use of HRAs in general practice include difficulties in interpreting scores from these instruments, which may be influenced by patient mix, timing of data collection, and measurement properties (i.e. threshold for normal versus abnormal scores). In addition, clinicians may be skeptical regarding the benefits of preventive services and uncertain about

appropriate guidelines for offering these services. Several national programs have attempted to address these concerns. The scope of the problem, in terms of desired objectives, has been delineated by *Healthy People 2000*. This document described 300 objectives to reduce preventable morbidity and mortality.

Put Prevention into Practice (PPIP) is a program to implement the *Healthy People 2000* goals. PPIP includes broad-based guidelines for medical personnel (both clinicians and office staff) as well as for patients regarding preventive care services. The approach of PPIP seeks to present a variety of messages from different communication channels to help prompt behavioral change. The rationale to this approach is that the cumulative effect of multiple messages with varied channels of communication will have a greater impact than the sum of the individual components.

HEDIS has developed standardized measures for the performance of health care services in HMOs, including preventive care. HEDIS measures are likely to become the national standard in assessing medical care outcomes.

Even with the PPIP program and HEDIS measures, implementation of preventive care programs in managed care environments can be difficult. Health care settings need to personalize the HRA and prevention services. For example, numerous health care settings (Harlem Hospital, Harvard Medical Plan) have adopted a personalized version of PPIP with the hospital/health care plan logo on all materials. This is important because patients feel that this is something more "personal" than a Public Health Service Initiative.

D. Recommendations

Many of the HRAs currently in use in civilian or military settings do not specifically collect information on needs for preventive services. Therefore, none of the instruments in their current forms will be appropriate for use in TRICARE enrollment. In addition, it will be important to use information from the HEAR instrument to collect baseline data related to *Healthy People 2000* objectives, HEDIS measures, and TRICARE benefit measures as well as preventive service needs for PCMs. The overall extent of questions on preventive care services must be limited as the entire instrument should not require more than 30 minutes to complete. We envision the instrument containing a grid of preventive health services, with answers indicating the most recent time that each service was received. A separate set of questions will be used for risk behaviors, to indicate needs for counselling or other health promotion interventions. Collection of information on cardiovascular health status, such as fitness and diet, may also be performed; however, due to time limitations, detailed information of this type cannot be collected and the usefulness of limited fitness and diet information must be explored.

The initial step in developing the HEAR instrument will be to specify the list of preventive health needs, *Healthy People 2000* objectives, HEDIS measures, and TRICARE benefit measures that need to be assessed. This list should be assembled by a group of DoD and civilian health personnel, with attention being paid to both long and short term needs. From the information supplied to Battelle by TRICARE and OPHSA personnel, we believe that target areas for the HEAR instrument focusing on *Healthy People 2000* objectives and HEDIS measures may include childhood immunizations, cholesterol screening, mammography, pap smears, tobacco use,

obesity, alcohol and drug use, physical activity, seat belt use, and family planning. In addition, areas to assess for TRICARE benefit measures include lead screening, clinical breast examination, blood pressure check, clinical testicular examination, fecal occult blood determination, and sigmoidoscopy/colonoscopy.

The instruments developed for Project HEAR to assess preventive service need to be compatible with nationally-used HRA instruments. This will allow for comparisons of findings between TRICARE enrollees and national samples or subsamples. Dr. Gemson developed a set of patient instruments for evaluation of PPIP, to collect both baseline use of preventive services and use following implementation of PPIP. These instruments were later modified by Battelle, under contract to the U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. These instruments will be distributed nationally to organizations interested in evaluating the impact of PPIP. In addition, many of the questions for this instrument have already been field-tested and shown to be valid and reliable; use of these questions will allow for more rapid implementation of this component of Project HEAR. Other questions may come from civilian instruments such as the National Health Interview Survey (NHIS) or the Carter Center/CDC HRA as well as DoD instruments such as the Annual Survey of Beneficiaries or the Army's "Fit to Win" HRA.

If there are additional areas of preventive service needs not covered by the PPIP evaluation instrument, questions should be taken or adapted from other nationally-used instruments whenever possible. This may include the BRFSS, the National Health Interview Survey (NHIS), and the Carter Center/CDC instrument. For internal military comparisons, it may be useful to

adapt questions from other military HRAs, such as the planned DOD annual beneficiary survey or the Army's "Fit to Win" Program.

The HEAR instrument should be implemented as early as possible in the HMO's planning process. It is significantly easier to develop and implement preventive care measures early in a HMO's process, since preventive care programs, notably HEDIS, require the integration of all automated data systems. It will be important to develop a computerized database for use with the HEAR instrument. The database should be designed to accept optically-scanned data, store questionnaire information, and produce reports for PCMs. The database should also be used to track TRICARE enrollees in order to determine whether needed preventive care or interventions were received and, ultimately, whether behaviors or chronic disease risks/incidences change following preventive services. The reports for PCMs produced by the database should be in a form easily incorporated into patient medical charts. The form of these reports should indicate preventive medical care, counselling, and other health promotion interventions needed by the patient. Space on the form will be provided for specifying when the preventive service was scheduled or performed. These forms should be developed in collaboration with military PCMs to make sure that they are of optimal use.

As discussed in the introduction to this section, a secondary objective is to develop an information sheet to go directly to each TRICARE enrollee. This sheet should contain specific information about the enrollee's health risks and preventive care needs; however, an overall risk score reflecting individual mortality risks or adjusted age will not be included. To maintain consistency with the PPIP program, language in this sheet may be based on the PPIP Patient

Passport. An important goal for this sheet is to increase the likelihood that TRICARE enrollees will schedule appointments with their PCMs.

The following recommendations pertain to implementing a preventive care assessment and evaluation programs such as PPIP. Training should be provided to *all* staff participating in preventive care, health care providers as well as office staff. Training should include structured sessions explaining the rationale for implementation, appropriate use of materials, and the significance of follow-up.

Patients are an integral part to preventive health care and health-related behavioral changes. Office and clinical staff need to spend time involving patients in their own personal health care. The PPIP set of materials includes a Personal Health Guide which offer brief explanations of prevention topics and risk factors, such as weight, blood pressure, immunizations, etc.

Finally, the interviewed experts stressed that many difficulties can arise in implementing a preventive care program. We recommend contacting representative of other HMOs early in the implementation process to take advantage of their familiarity with PPIP, HEDIS, and other relevant programs and thereby avoid some of the difficulties they have encountered.

PREDICTION OF HIGH RESOURCE AND PCM TIME UTILIZATION

In this section, we address the Project HEAR objective of identifying TRICARE enrollees likely to be utilizers of high levels of medical resources or PCM time. The goal is not, as in many of the studies reviewed, to predict future medical expenditures for enrollees; rather, we hope to identify which enrollees are likely to be members of groups which are (on average) high utilizers. While these two tasks are similar and involve the collection of comparable characteristics, the analysis of these data will differ. Further, identification of high utilization groups should be easier than prediction of actual expenditures, and the available data should have greater predictive value (as discussed below) for this function.

This section discusses whether a population consistently responsible for high levels of resource utilization exists in managed care systems; this would be the important population to identify for this objective of Project HEAR. The methodology used in predicting future medical expenses for individuals is examined in detail. Making such individual-level predictions is highly limited, suggesting that identifying groups of high utilizers is a more feasible approach. A large number of studies examining identification of both high-utilizing individuals and group are reviewed and summarized. These studies include analyses of broad populations as well as subgroups with specific medical care needs. Results from these studies are summarized in Table 3 and factors used to predict utilization are presented in Table 4.

We perform a similar review of the literature relevant to predicting high utilizers of PCM time. However, few studies have been reported in this area, and the available literature focuses only on length of ambulatory care visits.

We interviewed a number of experts in the field of predicting resource utilization and summarized their remarks. Some of these experts have extensive experience in identifying high utilization populations as part of a proprietary service; however, these individuals were understandably reluctant to discuss the specifics of their methodologies. We analyzed the literature and interviews, discussing the limitations in this field. Finally, we make recommendations regarding the type of data to collect in the Project HEAR instrument for this objective.

A. Literature review

1. Consistency of high resource utilization among HMO populations.

A major goal of this project is to determine the feasibility of identifying populations which are likely to be high utilizers of medical resources and/or primary care managers' time. In any given year, most individuals will have little or no medical resource utilization while a small group is generally responsible for a substantial proportion of the total utilization (McFarland et al., 1985; Hornbrook et al., 1991a). One recent study estimated that the 1 to 2% of the total population with the highest medical expenditures incurred 15 to 30% of total medical costs, and the top 10 to 15% accounted for 70 to 90% of the total costs (Yen et al., 1994).

McFarland and colleagues, using records from 1,401 adults continuously enrolled in the Kaiser Northwest HMO from 1967 to 1973, examined whether individuals comprising this high utilization population remained the same in subsequent years. High utilizers were defined as

individuals whose medical costs were in the upper quartile for this population in at least five of the seven study years. Overall, 13% of the study population was classified as high utilizers. This group was responsible for 31% of doctor office visits, 35% of hospital admissions, and 30% of outpatient surgical services. This group also had greater use of mental health services as compared to other segments of the study population.

Results from this study indicate that individuals who have higher medical costs tend to continue high utilization in subsequent years. An individual with high utilization in one year had a 53.6% likelihood of being a high utilizer in the following years. With two consecutive years of high costs, the likelihood of high utilization in the third years was 65%. For three, four, or five years of high costs, likelihoods of high utilization in the following year were 70%, 76%, and 80%, respectively.

A similar study was performed by Yen et al. (1994) examining medical claims costs from employees of a large manufacturing firm from 1985 to 1990. The study population was restricted to 7,796 employees who worked for the firm for at least one year in this time period, belonged to the company's indemnity plan for at least one year, and were unlikely to have external insurance coverage. Costs were totaled on an annual basis for each employee, with pregnancy-associated costs excluded. The 10% of employees each year with the greatest medical claims costs were designated as being "high-cost". The odds of an employee being repeatedly classified as high-cost (across multiple years of this period) were significant. Thus, once an employee reached high-cost status in one year, he or she was likely to remain high cost in subsequent years.

2. Methodology and limitations for identifying high-utilization populations.

Much of the literature in this field has involved models to estimate future medical expenditures. In order to evaluate the feasibility of this methodology, it is important to assess its basic structure and limitation. In the simplest context, total health care expenditures for a specific patient in a given year are a function of individual characteristics of the patient (e.g., gender, age, chronic conditions) which do not vary (or vary slowly) with time and specific health circumstances (e.g., accidents, acute conditions) for the patient during the year of interest. In statistical terms, health care expenditures can be modeled as

$$E_{it} = A_i + G_{it} , \quad (1)$$

where E_{it} is the total health-care expenditure by the i -th patient in the t -th year; A_i is a time-invariant component of expenditure specific to a patient; and G_{it} is a time-varying component of expenditure specific to a patient and year. A_i may also be interpreted as the between-patient component of expenditure while G_{it} is interpreted as the within-patient component of expenditure. All three of the terms in Equation (1) are random variables and it is assumed that the between-patient (A_i) and within-patient (G_{it}) components of the expenditure are independent. If the variances of the terms on the right-hand side of Equation (1) are defined to be

$$Var[A_i] = \sigma_i^2 , \quad (2)$$

and

$$Var[G_{it}] = \sigma_T^2 , \quad (3)$$

then the variance of expenditures in any given year can be written as

$$\text{Var}[E_{it}] = \sigma_I^2 + \sigma_T^2. \quad (4)$$

Let ρ_T denote the correlation between the within-patient components for consecutive years (e.g., G_{i1} and G_{i2}). It is assumed that the correlations between the within-patient expenditures for years t_1 and t_2 will decrease as the difference between t_1 and t_2 increases. For the present analyses, it is assumed that the correlation between any two within-patient components of utilization is

$$\text{Corr}[G_{it_1}, G_{it_2}] = \rho_T^{|t_2 - t_1|}, \quad (5)$$

where t_1 and t_2 are the indices of two of the yearly periods. Using this model, the correlation between total expenditures in two different years can be written as

$$\phi_{t_1, t_2} = \text{Corr}[E_{it_1}, E_{it_2}] = \frac{\sigma_I^2 + \rho_T^{|t_1 - t_2|} \sigma_T^2}{\sigma_I^2 + \sigma_T^2}. \quad (6)$$

A model similar to this was discussed in a technical note in Newhouse et al. (1989).

Newhouse et al. (1989) also discussed a limit on the proportion of the variance of the total expenditure that could be explained by the between-patient component or, in other terms, the proportion of variance that could be explained if one could estimate A_i without error. In the context of the model described above, this proportion can be written as

$$\begin{aligned} Q_0 &= 1 - \frac{\text{Var}[E_{it}|A_i]}{\text{Var}[E_{it}]} = 1 - \frac{\sigma_T^2}{\sigma_I^2 + \sigma_T^2} \\ &= \frac{\sigma_I^2}{\sigma_I^2 + \sigma_T^2}. \end{aligned} \quad (7)$$

Thus, when the variance of the within-patient component (σ_T^2) dominates that of the between-patient component (σ_I^2), the proportion of explainable variance is small. Conversely, if the between-patient component (σ_I^2) dominates that of the within-patient component (σ_T^2), the proportion of explainable variance is large.

This concept of explainable variance can be extended to include an assumption that one could estimate both the between-patient component (A_i) and the within-patient component of expenditure (G_{it}) for year t without error. Under these conditions, the proportion of explainable variance in the total expenditures for the following year can be written as

$$Q_1 = 1 - \frac{\text{Var}[E_{i,t+1}|A_i, G_{it}]}{\text{Var}[E_{i,t+1}]} = \frac{\sigma_I^2 + \rho_T^2 \sigma_T^2}{\sigma_I^2 + \sigma_T^2} . \quad (8)$$

Equation (8) shows that there are two conditions under which the proportion of explainable variance is large. The first condition occurs when the variance of the between-patient component (σ_I^2) dominates that of the within-patient component (σ_T^2). If this is not the case, the second condition is if the correlation between within-patient components is large.

Interpreting Equation (8) in a more practical sense, there are three conditions under which a significant portion of variability in health care expenditures can be explained:

- (1) When the between-patient variability (σ_I^2) dominates the within-patient variability (σ_T^2) and patient-specific measures which correlate well with long-run average patient expenditures can be observed.
- (2) When the within-patient variability (σ_T^2) dominates the between-patient variability (σ_I^2), within-patient expenditures from consecutive years are highly correlated (large ρ_T), and current patient expenditures can be observed.
- (3) When neither between-patient variability (σ_I^2) nor within-patient variability (σ_T^2) dominates the other, within-patient expenditures from consecutive years are highly correlated (large ρ_T), patient-specific

measures which correlate well with long-run average patient expenditures can be observed, and current patient expenditures can be observed.

The statistical analysis of the RAND study discussed by Newhouse et al. (1989) enables us to insert parameter estimates into some of the Equations discussed above. These authors claim that the maximum proportion of variance that can be explained by the model of Equation (1) is 14.5%. This value corresponds to Q_0 defined in Equation (7). Equation (6) can be rewritten for differences of one year in terms of ρ_T and Q_0 as

$$\phi_{t,t+1} = Q_0 + \rho_T(1 - Q_0) . \quad (9)$$

Newhouse et al. obtained four estimates for $\phi_{t,t+1}$ whose mean is equal to 0.192. From these estimates of Q_0 and $\phi_{t,t+1}$, and Equation (9), ρ_T can be estimated as

$$\rho_T = \frac{(0.192 - 0.145)}{(1 - 0.145)} = 0.055 . \quad (10)$$

Q_1 can also be redefined in terms of ρ_T and Q_0 as

$$Q_1 = Q_0 + \rho_T^2(1 - Q_0) . \quad (11)$$

Using the data from the RAND experiment, Q_1 can be estimated to be 0.148.

Newhouse et al. (1989) also present some results from Welch (1985), whose model is similar to Equation (1). Using data from Beebe (1985), Welch estimated $\phi_{t,t+1}$ to be 0.22 and Q_0 to be 0.12. Using these values and Equation (9), ρ_T can be estimated to be 0.114. Also, Q_1 can be estimated to be 0.131.

Thus, using either set of estimates, the potential explainable variance is less than 15%. The reasons for this small percentage are that the within-patient variability (σ_T^2) appears to dominate the between-patient variability (σ_I^2) and the within-patient expenditures from

consecutive years do not appear to be highly correlated (small ρ_T). In summary, none of the three conditions are satisfied under which a significant portion of the variance in expenditures might be explained.

This appears to contradict the finding discussed in the previous section, that consistency groups of HMO patients are responsible for a majority of annual medical expenditures. This discrepancy may result from the skewed nature of medical expenditures (which will be zero or very small for most of the population but very large for a minority of the population) and the difference between prediction of individual medical expenditures versus identification of high utilization groups.

3. Identification of high resource utilizers - general studies

Research attempting to identify individuals or populations likely to incur higher levels of medical costs fall into two categories: studies examining general populations and studies focusing on specific subpopulations. We will first discuss general population studies.

McFarland et al. (1985) examined characteristics of individuals classified as high utilizers as described above (1,401 adults continuously enrolled in the Kaiser Northwest HMO from 1967 to 1973). No relationship was observed between utilization patterns and marital status, income, occupation, perceived social class, smoking history, current drinking practices, and present level of physical activity. High utilization was correlated with lower (worse) scores on indices measuring mental health, physical symptoms, health concerns, and self-rated health status. This group also had a greater prevalence of clinical depression. Multivariate analysis indicated that

high utilization status was significantly associated with gender, mental health index score, and fair or poor health status; however, this analysis explained only 5% of the variance in total medical costs and 13% of the variance related to doctor office visits.

An earlier study by this group of 2,603 individuals continuously enrolled in Kaiser Northwest HMO during 1969 and 1970 had similar results (Freeborn et al., 1977). Socioeconomic status was not related to medical resource utilization. The main predictors of high utilization were self-assessed health status and mental health scores.

Several studies have examined the Adjusted Average Per Capita Cost (AAPCC), a rate adjuster used by Medicare. This typically uses age, gender, welfare status, and institutional status to adjust capitation rates. However, Lubitz et al. (1985) showed that this explained only 0.6% of variation in annual Medicare-covered expenses. Newhouse et al. (1989) used utilization data collected from the RAND health insurance experiment in 1974 through 1982 to attempt to develop better predictors of resource utilization. This study, which included a population of 3,958 individuals (7,960 person years) between the ages of 14 and 65, captured approximately 90% of all utilization. Dental and out-patient mental health visits were not included. Variables examined in this study included demographic characteristics, self-reported health status, health condition questions (asked as both dichotomous [yes/no] and continuous variables), and prior utilization. Estimates of the effects of the predictor variables were obtained by fitting a four-equation regression model.

Results were expressed in terms of the percentage of the maximum explainable variance. As discussed in section 2 (above), this study estimated that only 13.8% of the variation in medical

resource utilization can be explained. Using multivariate analysis, this study showed that demographic characteristics by themselves predicted 11% of the explainable variance; by addition subjective health status, explained variance was increased to 19%. Combining demographics with dichotomous or continuous health status questions resulted in 31% and 29% of the explainable variance, respectively. Prior utilization plus demographics captured 44% of the explainable variance; addition of dichotomous health questions resulted in an increase to 55% of the explainable variance.

Similar results were obtained by Hornbrook et al. (1991a) using data from a subset of Kaiser Northwest enrollees. This study examined predictors of utilization in a group of individuals less than 65 years old who were followed from 1980 through 1987. In this population, demographics explained only 2% of variance in annual per capita expenses. Dichotomous questions for previous year's morbidity explained 5.5% of variance in total medical costs, with "serious malignancy" adding the most of any morbidity class. Previous year's drug use explained approximately 4% of the variance. Use of most classes of drugs was associated with increased expenditures, with hypoglycemics, cardiovascular drugs, and therapeutic nutrients (e.g., potassium supplements) being the most expensive. Interestingly, use of antihistamines was associated with decreased resource utilization in the following year.

A combined multivariate model of demographics, morbidity classes, and drug use explained 7% of variance in total costs. Serious malignancy, sexually transmitted diseases, and therapeutic nutrients were significantly associated with increased future expenditures while cardiovascular drugs, diuretics, and antihistamines were associated with decreased future costs. Each of the regression models in the study was validated using data that had been withheld from the

regression analysis. In all cases, the models over-predicted the mean per capita expense by less than 2%, which represents about \$6 per individual per year.

A related study by Hornbrook et al. (1991b) showed similar results. Separate surveys of Kaiser Northwest enrollees were performed in 1980 and 1985. Results from the two surveys were similar, although the 1985 results were able to explain more variance than those from 1980. Demographics (age and gender) were able to explain 2% of variance in total costs, while prior utilization of outpatient services explained 2.2%; combined, these two explained 2.6%. Subjective health status explained 4.7%. Adding functional indicators (e.g., needing assistance in housework) to subjective health status brought variance explained up to 18.2%; removing an outlier from this model brought this up to 35%. The most predictive functional status question was "experience trouble getting around". Overall, the best predictors of future utilization were prior outpatient service use, demographics, perceived health status, and functional status. Performance of the predictive models was evaluated using validation data omitted from the regression fitting. All of the models over-predicted mean per capita expenditures, with the difference between actual and predicted means ranging from 0.43 to 27.0% of the mean in 1980 and from 0.9 to 18.1% of the mean in 1985.

Van Vilet and van de Ver (1992) carried out a similar study in the Netherlands. This study was based on 35,000 individuals insured for 5 consecutive years (1976-1980) by the largest private health insurance organization in the Netherlands. A subset of 14,000 individuals had additional information available regarding health status indicators (days of illness, relative health, number of physician consultations, and cost of prescription drugs).

In this population, age and gender by themselves explained approximately 2% of the variance in annual health care expenditures. Adding employment status, family size, income, education level, and degree of urbanization increased explained variance only to 2.7%. Adding prior utilization to the age and gender model had a major impact, increasing explained variance to 7.2%. Prior utilization was coded as two variables: a dichotomous variable (yes/no) for any costs in the prior year, and the logarithm of the total costs for the prior year if the costs were greater than zero. Breaking down prior utilization costs into several cost categories (physiotherapy, psychiatry, medical devices, miscellaneous outpatient, and inpatient) did not result in qualitatively different results from the total cost model, as the explained variance using multiple cost categories was 7.3%. Addition of the health status indicators to this model increased explained variance only to 7.4%.

The authors of this study also used data from 20,000 respondents to the Dutch 1981-1982 Health Interview Survey to examine predictors of health care expenditures. These data are more representative of the entire Dutch population and include chronic diseases and similar measures. Chronic diseases were coded as dichotomous (yes/no) responses to 25 conditions including rheumatism, heart conditions, hypertension, stroke, diabetes, anemia, asthma, hernia, cancer, and accidents. The data has the disadvantage of not containing longitudinal information.

Similar to the model based on private insurer data, age and gender explained 2.8% of variance in total medical expenditures. Addition of employment status and family size increased this to 3.2%; further addition of socioeconomic status, body weight, and degree of urbanization brought this to 3.7%. Extension of the model to include chronic disease conditions increased explained variance to 7.1%. Further addition of physical impairments and self-rated general health status

increased this to 10.9%. The results from these two different data sets indicate that direct health measures (e.g., chronic disease conditions) are better predictors of utilization than indirect measures (e.g., prior utilization).

Yen et al. (1991, 1992, 1994) examined predictors of medical costs among employees of a large manufacturing firm. In their initial study, Yen et al. (1991) examined 1,838 employees aged 18 to 64 who were continuously employed from 1985-1987 and were enrolled in the company's traditional medical insurance plan for this three year period. Medical costs were totaled each year, with pregnancy costs being excluded, and an annual cost for each employee was determined as a three-year average. As this cost data were highly skewed, patients were classified as high-cost versus low-cost relative to the mean. Additional information on this population was collected using a health risk appraisal form modified from the CDC design and a small number of clinical parameters collected by medical personnel.

Results from this analysis indicated that higher medical claims costs were associated with females, younger age (among this working-age population), increased absenteeism from work, medication/drug use, alcohol consumption, and smoking. Higher costs were also associated with HRA scores related to physical health, life and job satisfaction, and stress. There was no significant association between higher costs and level of physical activity or seat belt use. In terms of clinical parameters, higher costs were associated with employees having chronic bronchitis or emphysema; no significant relation to costs was seen for relative body weight, cholesterol level, risk age index, or systemic or diastolic blood pressure.

A later study by Yen et al. (1992) examined a similar population of 1,284 employees who completed a 1985 HRA, were covered by the company's traditional medical insurance policy for 1986 and 1987, and whose absenteeism was recorded for these two years. Using a similar methodology to that described above, higher medical costs were significantly associated with female gender, older age, drug/medication use, psychological perception index (including stress, physical health, job and life satisfaction, and social support), 12-month self-reported absence days, and personal health problems. Multivariate analysis was then performed separately for males younger than 35, males 35 or older, and females (all ages combined). Higher medical costs for younger males were predicted by personal medical problems, increased absence days, and drug/medication use; for older males, these factors plus older age and psychological perception index were significantly predictors. The only relevant significant variable associated with higher costs for females was personal medical problems. Smoking, physical activity, systolic or diastolic blood pressure, and cholesterol level were not significant predictors for any of these groups.

The most recent study by Yen et al. (1994) used a larger population, examining costs of 7,796 employees who worked for the firm and belonged to the indemnity plan for at least one year in the 1985-90 time period (as discussed in section I, above). Multivariate analysis indicated that significant predictors of high-costs employees included older age, being single, having more than 6 days absenteeism in the past year, self-reported medical problems, and current smoking status.

Dr. Wendy Lynch and colleagues at Health Decisions, Inc., have recently developed an instrument for use in predicting high resource utilizers. This instrument is named the Predictor Cost Risk Assessment (Health Decisions, 1994). While in preliminary stages, this instrument

has been reported to identify the individuals who will account for 60% of health care utilization in the following 2 years. Unlike standard HRAs, this instrument focuses on short-term predictors of utilization, non-serious as well as serious illnesses, and factors that influence demand for medical services. Dr. Lynch and colleagues contend that many standard utilization predictors, such as current morbidity, account for a relatively small amount of variation in medical use (10-25%). The strongest predictor of future utilization is past utilization. This is in turn influenced by perceived need of medical services, which can account for 25-50% of the variation in utilization. In the program developed by Health Decisions, Inc., individuals identified as potential high utilizers are then targeted for specific support services, which coincide with the reasons for utilization.

4. Identification of high resource utilizers using national surveys.

The use of national surveys for health risk assessment was discussed under the first component of Project HEAR. Data from national surveys have also been used to identify high resource utilizers. While many of these studies do not have as much detailed information as to regional studies, they are applicable to broader population groups. Berki and Kobashigawa (1978) used data from a subsample of 10,000 respondents to the 1970 National Health Interview Survey to examine the impact of income and education on ambulatory care utilization. This study used a path-analysis technique which allowed for separate identification of direct and indirect effects of these two predictors. Their analysis indicated that family income does not have a direct effect on the use of ambulatory care services. However, the indirect effect of family income was inversely related to utilization (i.e., increased family income was associated with decreased ambulatory care visits). The main indirect effect of family income was manifested through the

prevalence of chronic disease conditions; individuals with a higher family income tended to have lower prevalence of chronic conditions and, thus, few ambulatory visits.

A similar analysis was performed examining education. Education had a significant direct effect, with greater education being associated with greater use of ambulatory services. However, education had an indirect effect in the opposite direction, decreasing utilization. This indirect effect was due to individuals with greater education having higher family income, lower prevalence of acute illnesses, and decreased likelihood of being unemployed. The combined direct plus indirect effects of education on ambulatory care utilization were in the direction of the direct effect (greater education being correlated with greater utilization) but the magnitude of this relationship was reduced by the indirect effect.

Buczko (1989) used data from 7,643 non-institutionalized respondents to the 1980 National Medical Care Utilization Expenditure Survey to look at predictors of hospitalization. First, a two stage model was used to examine factors related to having any hospitalizations during the study year. This model indicated that individuals with fair or poor self-reported health status (as compared to good or excellent) or increased numbers of bed days were more likely to have at least one hospitalization. The model explained 14% of the variance in this dependent variable.

A second model examined factors related to experiencing multiple hospitalizations. In this model, the presence of specific health conditions were the most significant predictors of multiple hospitalizations; of the health conditions, cardiovascular disease was the most significant. Increased bed days, above average income, and unemployment were also associated with

increased numbers of hospitalizations. Self-reported health status was not significantly associated with multiple hospitalizations.

Roos et al. (1988) used data from 3,036 respondents to the Manitoba Longitudinal Study on Aging. In this study, 1971 interview data were combined with 1970-1973 claims data. Measures developed in 1970 and 1971 were used to estimate predictors of hospitalization in 1972 and 1973. Two main measures were the hospital illness scale (categorical measures of the number of hospital discharges, number of hospital days, number of diagnoses per admission, and number of surgical procedures) and the ambulatory illness scale (categorical measures of the number of different diagnosis codes, number of chronic disease doctor visits, number of serious or urgent doctor visits, and number of doctor visits involving diagnoses with increased risk of not recovering from the illness). Step-wise logistic regression was used for this model, with a bootstrap procedure to check the appropriateness of variables entering the regression.

Significant predictors of hospitalization included being unmarried, increased age, female gender, self-reported health status (poor or fair versus good or excellent), and higher scores (indicating greater or more serious health care utilization) on the hospital illness and ambulatory illness scales. Separate regressions were performed to predict the number of hospital days in 1992. Significant predictors of being hospitalized for more days included older age; having a living spouse; having spent at least 45 days hospitalized in the previous year; having one or more disability; self-reported health status (as above); and ambulatory illness, hospital illness, and mental status questionnaire scores. This model explained 15% of variance in the number of days hospitalized.

5. High resource utilization among patient subgroups.

A number of studies have examined medical resource utilization pertaining to specific types of care or to specific population subgroups. We have examined the literature for three potentially high utilizing groups: users of mental health services, elderly individuals, and cigarette smokers.

i) *Mental Health Patients*

Large studies have been conducted to determine explanatory factors or predictors related to use of ambulatory mental health (MH) services. Diehr et al. (1986) studied state employees and their dependents (no retirees) in HMO settings (Blue Cross, United Healthcare and Group Health Cooperative) in Washington State for 18 months. Interviews were used to collect data on MH status and attitudes towards health care as well as medical record and claims data. Type and quantity of MH service use and interactions with types of insurance plans were examined. A modified Langner/Srole scale was used to define MH "need." Eight percent of those studied used some type of MH services during the 18 months study period, with highest MH service use among those 30-40. There were no gender differences, which contradicted earlier Rand findings. Variables correlated with MH use, controlling for age/gender, included occupation; lower perceived health status; and a higher number of chronic conditions, disability days, prior utilization, and MH need. Correlates with the number of visits or higher costs included higher education and income; better perceived health status; less access to home care; and higher job status. A high false positive rate made the MH "need" index unacceptable for prediction.

Wells et al. (1986) studied predictors of use of ambulatory mental health services and related costs among persons randomly assigned to Group Health Cooperative (GHC) in Seattle or one

of 11 fee-for-service plans. This MH service utilization was compared with that of a non-random GHC control group, using data from the Rand Health Insurance study. This year-long study used 1976 data from medical records and claim forms. Individuals who were elderly, institutionalized, on active military duty, military veterans, or higher income were excluded. A Mental Health Inventory (MHI) was used for data collection. Over the 12 months, 13% used any GHC services, 5.5% used family pay plans, and 9% used free care plans. There was a 3-fold difference in any use and a 5-fold difference in use of specialists across three groups: children (lowest), adult males, and adult females (highest). Lowest income groups had significantly higher probability of MH use, specialist visits and higher costs in both GHC and fee-for-service settings. College education made MH specialist use more likely. The annual cost of MH care increased 4-fold as a function of the MHI measure tercile. Any physical or role limitation doubled the probability of MH service use and at least doubled the cost.

Borus et al. (1985) tested the hypothesis that there is an "offset effect" for timely MH specialist treatment, resulting in lower subsequent MH care utilization and associated charges. Settings were Bunker Hill Health Center (BHHC) in Boston, a fee-for-service facility, and Columbia Medical Plan, a pre-paid group practice. BHHC patients with MH disorders treated by a specialist within a year of diagnosis were compared with patients who had not received as timely MH specialist care. Retrospective data included ambulatory medical and MH service utilization and charges. Utilization of non-psychiatric services was lower for the treatment group despite more severe MH problems in this group; associated charges were also lower. However, MH specialist care for the patients treated within 12 months increased total (MH and non-MH) utilization. Measures of clinical outcome were not included in the comparison of groups.

Factor analysis was used to study the ability of scores derived from a 30-item General Health Questionnaire (GHQ) to determine predictors of mental and other health services and rate of use of service (Berwick et al., 1987). New members (n=2,394) of Harvard Community Health Plan (HMO), aged 21-65, completed a GHQ and an 8-item Current Health Scale (from RAND's General Health Perceptions Questionnaire) at enrollment and at six month intervals for 24 months. A sample of 244 respondents with baseline and six month results were stratified into high/high, low/low, low/high, high/low or mid/mid scores at baseline and six months to determine if consistently high scores correlated with high resource use for scheduled and unscheduled non-mental health visits, mental health visits, and total visits. The GHQ and Current Health Scale were both completed twice by 1,181 enrollees.

Utilization of care was four times higher for both men and women in the high/high scoring group compared to the low/low group, but with a skewed distribution within groups. Anxiety, depression, and social function factors were significantly associated with entry into mental health care; anxiety and social function were significantly associated with unscheduled visits. No important association with the rate of utilization was evident except that depression was associated with the use of scheduled non-mental health care. The regression models using GHQ scores accounted for 10% of variance in utilization rates among health care users. High GHQ scorers, especially those with sustained high scores, were most likely to use services; those with "negative" factors of anxiety and depression were especially at risk. Relationships between health symptom patterns and health care use patterns are more complex than the scoring data (baseline and six month resource utilization) were able to reveal.

One Canadian study (Miller et al., 1986) developed a model to predict utilization of inpatient psychiatric care using key variables in addition to socioeconomic and demographic data for Hamilton, Ontario, a city of over 300,000 people. Assessment of the stability of prediction over time and patterns of under/over utilization were included. Utilization and episode rates for inpatients at three hospitals and census data from 73 city tracts were used in a regression model to predict utilization. Nine social indicators determined by factor analysis were included as independent variables: no high school education, elderly, never married, non-English speaking, primary residence a rental property, unemployed, social dislocation, resident of an area with heavy population growth/change, and high population density. In-patient utilization rates were significantly correlated with census tracts with a high proportion of rental properties, never-married persons, non-English speaking persons and those with less than high school education. These tracts corresponded to areas of under or over utilization of psychiatric services (demand and/or access to services). Models based on these variables appear to be stable in predicting utilization over a ten year period.

ii) *Elderly Patients*

Kaiser Permanente patients over age 65 with six years of continuous enrollment were studied to identify consistently high and low users of health care (Freeborn et al., 1990). They belonged to a 5% sample with complete, continuous, computerized data of all medical care contacts (encounters, phone calls, letters, etc.), procedures, drugs, tests, and hospital stays; participants responded to a mail survey to collect sociodemographic, health care attitude, patient satisfaction, and other data. Patients were categorized into groups of low, medium, or high users of care. Group health care resource use, ambulatory care costs, reasons for seeking care, and predictive factors of high and low use were compared. Medical care during last year of life was not

included. Predictor variables (gender, sex, marital status, education, perceived social class), enabler variables (income, existence of a regular physician, and satisfaction with care) and need variables (perceived health status, number and type of reported health conditions) were used in regression analysis.

High users of services (26%) were responsible for roughly half of all medical care contacts, office visits, and hospitalizations; low users (24%) were responsible for under 10% of use of each type of service. Mean ambulatory costs per year, in 1977 dollars, were \$409 for high and \$89 for low users, respectively. Use of MH services were negligible in both groups. High users were older (mean age 74 vs. 70 yrs) and more often female (65% vs. 52%). There were no differences for marital status, education, perceived social class, or income. Almost 60% of high users perceived their health as fair or poor, compared with 24% of low users; high users more often had arthritis or rheumatism (36% vs. 13%), high blood pressure (34% vs. 11%) or heart disease (29% vs. 7%). Consistent predictors of health care use over a six year period included age, availability of a regular MD, perceived health status, and number of medical conditions. High use appeared to reflect greater illness and disability which would be adversely affected by restrictions on access to medical care (e.g. by co-payments, limits on reimbursement).

Leigh and Fries (1992) studied the relationship between health habits and medical costs among a large self-selected group of Bank of America retirees in California in 1988-89 by comparing twelve months of data from intervention and control groups. Dependent variables included hospital days, doctor visits, and sick days. Independent variables included age, gender, education, minutes of exercise per week, body mass, number of cigarettes per week, seat belt use, and alcohol consumption. The intervention consisted of six month lifestyle questionnaires,

personal health risk reports, letters, a self-management book, and quarterly newsletters; controls received only the questionnaires. All habit variables were statistically significant and had the expected sign in relation to sick days. Age, years of education, higher body mass, excessive alcohol consumption, and cigarette use were positively associated with high direct and total medical costs. Male gender, exercise, and seat belt use were negatively associated with direct and total costs. When cost savings associated with changes in health habits were calculated, indirect cost savings were greater than direct cost savings.

Use of services and expenditures among elderly enrollees in an HMO in Massachusetts were examined for determinants of cost and utilization of ambulatory and inpatient care (Levkoff et al., 1992). A self-administered, multidimensional assessment instrument (Fallon Health Status Questionnaire) was completed at enrollment to the Senior Plan. Data included number of illnesses, hospitalizations, disabilities, activities of daily living (ADL), medications, allergies, depression, health habits, and sociodemographic data. Utilization data included hospitalizations, outpatient visits, ER and day surgery visits, MD encounters, referrals, home health services, skilled nursing services, and medical equipment. Factor analysis was used to determine the ten factors with the highest correlations to the original 55 variables: aloneness, past hospitalizations, general illness, mobility/disability, heart disease, mental health problems, high blood pressure, thyroid disease, arthritis, and pulmonary problems. Stepwise regression models were used to predict utilization and inpatient expenditures with these factors, plus age and gender.

Elderly enrollees with a chronic disabling condition made nine visits per year to doctors compared to four visits for enrollees without such conditions. Hospital days per 1,000 persons ranged from 313 for those with one chronic condition to 570 for those with three or more

conditions. Both dependent variables were predicted best by the presence of heart problems, followed by age, arthritis, and mobility/disability problems. Inpatient utilization was also predicted by mental health problems and past hospitalizations. In addition, ambulatory utilization and expenditures were predicted best by these variables, excluding age. All adjusted R^2 values were low, ranging from 3% to 11% for the outcome variables. Patient-related variables on health status questionnaire may better predict access to care or visit rates than intensity of resource use, which may be more dependent on physician-related treatment variables.

Rivnyak et al. (1989) used a LISREL model to determine the extent to which ambulatory care is affected by physical and mental dysfunction among the elderly. Health service agencies, senior citizen centers, and social service agencies in Richmond, Virginia provided a 5% sample of non-institutionalized clients for interviews (personal background, physical and mental status, medication use, health services use, safety practices, accident rates, and health care use). Health status factors such as ADL, number of bed-days, functional disability, perceived health, psychological symptoms, life satisfaction, and perceived emotional health were used to predict utilization (number of health care contacts in 6 months). Pfeiffer's Short Portable Mental Status Questionnaire was also used. Eleven factors in the model explained 29% of variation in ambulatory health care utilization. Physical dysfunction resulted in greater use and mental dysfunction resulted in less use of ambulatory health care. Other variables associated with greater use included higher education level, use of social services, younger age, female gender, and "perceived susceptibility." Less use was also associated with inappropriate use of medications.

A study of the impact of living arrangements and marital status on use of health care services (i.e., hypothesis of living with others as a substitution for marriage as being health-protective) was conducted by Cafferata (1987). NMCES national survey data were used to select households to interview in a civilian, non-institutionalized population. Path analysis explained relationships between the dependent variable (use of health care services and bed-disability days) and living arrangements, marital status, and several other exogenous variables. Marital status itself does not affect use of bed-disability days or use of formal health services. Effects previously attributed to marriage may have been due to the fact that married persons are more likely to live with others.

Medicare beneficiary data have been used to analyze the underwriting factors (age, gender, institutional status, and welfare status of non-institutionalized persons) for the adjusted average per capita cost (AAPCC) formula used to pay HMOs for medical services provided (Manton and Stallard, 1992). This study recommended adding a factor based on chronic disability. It demonstrated the effect of updating the AAPCC factors from using 1984 National Long-term Care Survey and Medicare Part A and B billing data, and simulated the dollar impact of these changes on HMOs for selected enrollee populations. Updates reflected demographic changes (e.g., aging population), changes in Medicare policies (e.g., the prospective payment system (PPS), provision of home health care, skilled nursing care), and changes in marketing and service provision (e.g., acute care hospitalization shorter LOS) that affect consumption of Medicare services. Updated underwriting factors and inclusion of disability as a factor can explain variations in Medicare costs more effectively (e.g. shift to Medicare Part B expenditures due to trends in using day surgery and outpatient care vs. inpatient care) than existing factors. The most elderly (85+ years) had the lowest differential in expenditures between disabled and

non-disabled; for other groups, the differential was approximately three to one and could affect HMO profits if selection bias occurs against disability at enrollment.

Epstein and Cumella (1988) reviewed 42 studies investigating predictors of medical utilization that might be included in the AAPCC such as: perceived health status, functional health status, prior use, and clinical descriptors. Table 1 in the article summarizes each study's sample size, population, data source(s), utilization definition, and predictor variables. Measures included ambulatory care use, hospital care use, and total medical care dollars. Data were collected from self-report interviews (49%) and medical care provider or third party payer records (51%). Predictors included the items already mentioned. Perceived health status was a significant predictor in 85% of the studies. Predictive power applied to hospital and ambulatory care utilization but there were insufficient data to determine effects on total medical costs.

The statistical significance of functional health status varied when measured by global (95% significant), activity impairment (39% significant) or limited-activity days (77% significant) measures. Global measures appeared to capture prediction of utilization better than more specific measures. Prior utilization was measured in studies using eight different databases and was significant as a predictor of utilization for ambulatory care (100%), hospitalization (100%), and total medical costs (88%). Indices of prior utilization may measure different and independently predictive characteristics; they are useful whether measuring intensity (94% significant) or cost (81% significant). Clinical descriptors were measured by the presence or numbers of health problems (chronic or acute) or hospitalizations for specific diagnoses. They were significant 94% of the time for total costs, 83% of the time for hospital use, and 75% of

the time for ambulatory care use. Sociodemographic factors were significant predictors only 44% of the time, compared with 50% of the time for the AAPCC factors.

Additional predictors (e.g., mental health, depression scales, use of social support services) were less successful in predicting utilization than the other measures although there is some evidence of poorer mental health being correlated with more ambulatory care use. Correlation coefficient data, when available, corresponded well to the above results, with prior utilization as the best predictor, followed by perceived health, functional health and clinical descriptors. The review is limited by lack of information regarding reliability, administrative burden of data collection, and predictive stability of examined measures.

The health needs of aging veterans have been studied to identify covariates of past and current use of health care services and intentions for future VA health care use (Kosloski et al., 1987). Interviews were conducted with male veterans over 54 years old using the Harris Survey questionnaire to gather information regarding medical diagnoses, ADL, demographic and background characteristics, accessibility of health care facilities, insurance coverage, attitudes about VA care, and VA eligibility. Sets of independent variables were recombined or converted to indices for regression analyses, with dependent variables being "current VA use" and "intended future use if price were half that elsewhere." One-third of the participants were either current users of VA services or users since military discharge; 56% indicated intention of future VA health service use. For current use, 13 aggregated medical diagnoses explained 10% of the variation in VA use. Very poor ADL scores were associated with less VA use (i.e., VA acute care facilities were not as frequently used by those with serious chronic disabilities) while better ADL was associated with higher VA health service use. Blacks, lower income veterans, and

veterans without private insurance coverage used VA services more frequently, as did those who had ever applied for service-related disability and those eligible for free VA care. Convenient VA facilities increased use, although inpatient stays were longer for those living further away. Mean LOS for surgery was 14 days in VA facilities. Future VA use was best predicted by past VA use, income, and perceived quality of VA services.

iii) *Cigarette Smokers*

A number of studies have concluded that cigarette smokers have greater lifetime medical expenditures than individuals who never smoke cigarettes (CDC, 1994). Utilization by former smokers is uncertain; various studies have reported that their utilization is greater, less, or the same as individuals who continue to smoke. This is due, in part, to the "quitting ill" phenomenon where former smokers may quit smoking due to the onset of disease symptoms or the diagnosis of a smoking-related condition. These individuals are thus classified as former smokers but consume significant health care resources for illnesses which developed while they were current smokers (Halpern et al., 1993).

A number of studies have attempted to examine health utilization by current and former smokers as compared to non-smokers (individuals who have never smoked). Halpern and Warner (1994) performed regression analysis using data from 41,104 respondents to the Health Promotion and Disease Prevention Supplement of the 1990 National Health Interview Survey. They found that current smokers had significantly more hospitalizations and ambulatory care visits than non-smokers. Former smokers initially had higher levels of utilization than current smokers; these utilization levels decreased with time since quitting, and eventually equalled those of non-smokers by approximately ten years following smoking cessation.

Chetwynd and Rayner (1986) examined 1,000 women between the ages of 18 and 60 at general practice centers in New Zealand. They found that smokers had more illness episodes, general practitioner visits, and hospital admissions than non-smokers. Heavy smokers had greater utilizations than moderate smokers. No significant differences were seen for specialist visits, out-patient clinic visits, or emergency admissions.

Vogt and Schweitzer (1985) examined the relationship between smoking and health care resource utilization in 2,582 adult members of the Kaiser Northwest HMO. Smoking status of these individuals was determined from a survey administered in 1970-1971; utilization data were collected through 1974. Univariate analysis indicated that current smokers showed greater levels of both inpatient and outpatient utilization than did never smokers. Former smokers showed inpatient utilization levels in-between current and never smokers but outpatient utilization levels were greater than those of current smokers. However, multivariate analysis indicated that the only smoking variable significantly related to utilization was years since cessation (for former smokers); longer time since quitting was significantly associated with fewer hospitalizations.

6. Predictors of high PCM time utilization

While many studies have examined factors predicting future medical costs, few have analyzed determinant of PCMs' time utilization. Such determinants will also be important for targeting patient interventions in TRICARE. The most relevant papers on this subject examine factors related to length of ambulatory care appointments with PCMs. Radecki et al. (1988) studied the nature of visits by the elderly to physicians using surveys for physicians. Patient encounters were classified by age group, inpatient vs. outpatient, medical specialty, first vs. follow-up visits, and

other variables. Ambulatory care mean encounter times were significantly shorter for older patients seen by GPs, internists, and cardiologists. For outpatients aged 65-74 years, mean visit duration was 18 minutes for internists and cardiologists, 11 minutes for GPs, and 12 minutes for family practitioners. Compared to a group aged 45 to 65 years, those age 75+ experienced significantly shorter ambulatory visits with GPs (1.2 minutes difference). Longer visit time is associated with multiple health problems, problem severity, and use of diagnostic tests. The more follow-up visits that occur, the shorter the encounter time. Higher patient volume per week and use of physician assistants (PAs) decrease visit length.

O'Bannon et al. (1978) examined selected variables in a prepaid group ambulatory practice to determine their influence on the amount of time physicians and PAs spent with Kaiser Permanente (KP) patients. System and patient variables were used in regression analyses to predict time spent with patients by providers. System variables included: clinic, type of appointment, day of week, episode type, chart availability, provider type, and patient load. Patient characteristics included symptoms, number of associated morbidities, age, gender, and presence of chronic disease. Analyses indicated that system variables were better predictors of time spent with patients than patient variables for either physicians and PAs. Independent variables explained 38% of the variation in physician and PA visits that did not involve both a physician and a PA (consultation visits). For non-consultation visits, scheduled 30-minute visits explained the most variation in time (>6 minutes longer). For 30-minute scheduled visits, every 1/10 unit increase in patient load (patients per minute) reduced visit time by over 8 minutes. Among the patient characteristics, each added morbidity added 1.3 minutes to the visit. Six of 17 possible symptom variables were significant: mouth, nose, ear and dermatologic symptoms took less provider time than visits with no presenting symptoms; psychiatric and digestive

symptoms took more time. Visit time varied 7.5 minutes between the least (dermatologic) and most (psychiatric) time consuming symptoms. Among unscheduled and 15-minute scheduled visits, there was a 12.5 minute decrease per tenth unit patient load increase and a 2.2 minute increase in visit length for each associated morbidity added. Follow-up visits for continuing problems add 4.9 minutes to the initial visit, on average. Patient load was also the most important variable affecting visits to an after-hours clinic. More variation was explained for physician than for PA visits when symptoms were included in the analysis.

Table 3
Summary of Studies Examining Predictors of Medical Resource Utilization

SOURCE	POPULATION	FINDINGS	VARIANCE EXPLAINED
1. General population studies			
Berki and Kobashigawa, 1978	1970 National Health Interview Survey respondents	Increased family income indirectly associated with decreased use of ambulatory care services; increased education associated with increased use.	Not stated
Buczko, 1989	1980 National Medical Care Utilization Expenditure Survey respondent	Health status and increased bed days predictive of hospitalization; specific health conditions (especially cardiovascular disease), increased bed days, increased income, and unemployment associated with multiple hospitalizations. Health status not associate with multiple hospitalizations.	14% of hospitalizations
Freeborn et al., 1977	HMO enrollees	Increased resource utilization associated with health status and mental health; socioeconomic status not predictive.	Not stated
Hornbrook et al., 1991a	HMO enrollees	Increased resource utilization associated with prior morbidity and medications.	2% to 7%
Hornbrook et al., 1991b	HMO enrollees	Increased resource utilization associated with functional status, health status, and prior outpatient utilization.	2% to 35%
McFarland et al., 1985	HMO enrollees	Increased resource utilization associated with gender, mental health, and health status.	5% of total medical costs, 13% of doctor office visits
Newhouse et al., 1989	Rand health insurance population	Only 13.8% of variation can be explained; useful predictors of increased resource utilization include health status and prior utilization	1.5% to 7.6%

Table 3
Summary of Studies Examining Predictors of Medical Resource Utilization (continued)

SOURCE	POPULATION	FINDINGS	VARIANCE EXPLAINED
Roos et al., 1988	Respondents to the Manitoba Longitudinal Study on Aging	Hospitalization predicted by unmarried status, increased age, female gender, health status, and worse scores on hospital illness and ambulatory illness scales; predictors of longer hospitalization included older age, greater than 45 days hospitalized in previous year, 1 + disabilities, health status, ambulatory and hospital illness scales, and mental health score.	15% of number of days hospitalized
Van Vilet and van de Ver, 1992	Individuals with private health insurance in the Netherlands	Prior utilization is the best predictor of increased resource utilization ; no difference is prior utilization is global or broken into categories.	2% to 7.4%
Van Vilet and van de Ver, 1992	Respondents to the Dutch 1981-82 Health Interview Survey	Increased resource utilization associated with chronic diseases, physical impairments, and health status; direct measures (e.g., chronic diseases) better than indirect (e.g., prior utilization)	2.8% to 10.9%
Yen et al., 1991	Employees	Increased resource utilization associated with female gender, younger age increased absenteeism, medication/drug use, alcohol consumption, smoking, physical health, life/job satisfaction, and stress; not associated with physical activity, seat belt use, or clinical parameters (cholesterol level, blood pressure, etc.).	Not stated
Yen et al., 1992	Employees	Increased resource utilization associated with female gender, older age, drug/medication use, 12-month absenteeism, stress, physical health, job/life satisfaction, and social support; also, significant age/gender interactions with certain predictors.	Not stated
Yen et al., 1994	Employees	Increased resource utilization associated with older age, single status, > 6 days absenteeism in past year, medical problems, and smoking.	Not stated

Table 3
Summary of Studies Examining Predictors of Medical Resource Utilization (continued)

2. Predictors of mental health (MH) resource utilization			
SOURCE	POPULATION	FINDINGS	VARIANCE EXPLAINED
Berwick et al., 1987	HMO enrollees	Increased MH resource use associated with anxiety, depression, social function factors, and high General Health Questionnaire scores.	10%
Diehr et al., 1986	HMO enrollees	Increased MH resource utilization associated with occupation, lower health status, chronic conditions, disability days, prior utilization, and MH need. Increased number of visits and costs correlated with higher education and income, better health status, less access to home care, and higher job status.	Not stated
Miller et al., 1986	Residents of Hamilton, Ontario	In-patient psychiatric utilization associated with never married status, non-English speaking, less than high school education, and residence in a rental property.	Not stated
Wells et al., 1986	HMO enrollees and fee-for-service users	Lower income associated with MH resource use, specialist visits, and higher costs. Physical or role limitations also associated with increased MH resource use.	Not stated

Table 3
Summary of Studies Examining Predictors of Medical Resource Utilization (continued)

3. Predictors of resource utilization among the elderly			
SOURCE	POPULATION	FINDINGS	VARIANCE EXPLAINED
Freeborn et al., 1990	HMO enrollees over 65	Increased resource utilization associated with older age, female gender, fair/poor health status, availability of a regular M.D., and number of medical conditions.	Not stated
Kosloski et al., 1987	Male veterans over 54 years old	Increased use of VA services associated with black ethnicity, lower income, lack of private insurance, history of service-related disability, eligibility for free VA use, and convenient VA location; decreased use associated with greater functional impairment (lesser ADL score). Future VA use predicted by past VA use, income, and perceived quality of VA services.	Not stated
Leigh and Fries, 1992	Retirees	Increased medical costs associated with older age, more years of education, higher body mass, excessive alcohol consumption, and cigarette use. Male gender, exercise, and seat belt use negatively associated with direct and total costs.	Not stated
Levkoff et al., 1992	Elderly HMO enrollees	Increased doctor visits and hospital days associated with chronic conditions, older age, and mobility/disability problems. Inpatient utilization was also predicted by mental health problems and past hospitalizations.	3% to 11% of doctor visits & hospital days
Manton and Stallard, 1992	Medicare population	Increased variance of Medicare costs can be explained by inclusion of disability status.	Not stated
Rivnyak et al., 1989	Non-institutionalized senior citizens	Increased use of ambulatory care service associated with physical dysfunction, higher education level, use of social services, younger age, female gender, and "perceived susceptibility." Decreased use associated with mental dysfunction and inappropriate use of medications.	29% of ambulatory care use

Table 3
Summary of Studies Examining Predictors of Medical Resource Utilization (continued)

4. Cigarette Smokers			
SOURCE	POPULATION	FINDINGS	VARIANCE EXPLAINED
Chetwyne and Rayner, 1986	Female patients of New Zealand general practitioners	Smokers associated with increased illness episodes, general practice physician visits, and hospital admissions than non-smokers; dose-dependent effects on utilization seen.	Not stated
Halpern and Warner, 1993	Respondents to the National Health Interview Survey	Smoking associated with increased hospitalizations and doctor visits; former smokers medical resource utilization decreases with time since smoking cessation.	Not stated
Vogt and Schweitzer, 1985	HMO enrollees	Smoking associated with greater levels of inpatient and outpatient utilization. Multivariate analysis indicated that years since cessation with the only significant smoking variable in predicting resource utilization.	Not stated

Table 4
Factors Related to Utilization Prediction

Predictor	Number of studies showing:	
	Related to utilization	Not related to utilization
Self-rated health status	11	2
Morbidity/chronic diseases	9	
Prior utilization	6	
Smoking history/cigarette use	6	1
Education	6	2
Functional status/mobility problems	5	
Mental health problems/risk	5	
Marital status	4	3
Income / socioeconomic status	4	4
Absenteeism	3	
Bed days/disability days	3	
Occupation/employment status	3	2
Life and job satisfaction	2	
Medication/drug use	2	
Physical health	2	
Self-reported medical problems	2	
Social function/use of social services	2	
Stress	2	
Current drinking practices	2	1
Access to home care	1	
Anxiety/depression	1	
Non-English speaking	1	
Use of medications	1	
Relative body weight	1	1

Table 4
Factors Related to Utilization Prediction (continued)

Predictor	Number of studies showing:	
	Related to utilization	Not related to utilization
Level of physical activity	1	2
Blood pressure		1
Cholesterol level		1
Family size		1
Risk age index		1
Perceived social status		2

B. Interviews with selected experts

1. Dr. Willard Manning, University of Minnesota, Minneapolis

Dr. Manning felt that the ability to predict who will be high users of medical resources depends on the data available. His studies had used a predecessor of the SF-36 form, which was long and expensive to collect. He suggested including a check list of chronic diseases and questions regarding prior utilization, although recall of utilization is unreliable; use of claims data gives better results. Medical utilization and expenditures are extremely skewed, so larger populations are required to accurately assess medical costs than would be needed to examine clinical measures. Further, predictions of resource utilization for individuals are very difficult; predicting at a group level is somewhat easier.

2. Dr. Mark Hornbrook, Kaiser Northwest HMO, Portland, Oregon

Dr. Hornbrook stated that the most powerful single variable in predicting future use of medical services is prior use, which is especially good at picking up patients with chronic diseases (e.g., asthma, COPD, etc.). Other useful questions include a chronic disease check-list, mental health and alcohol abuse screens, health status, and current types of medication being taken. More refined information is required to identify what is responsible for the high level of resource utilization in this population; for example, self-reported information will not supply specific disease or disease severity in many cases.

Dr. Hornbrook argued that identifying potential high resource users was useful only if there was an intervention available for this population that could address the cause of their utilization.

Current interventions, such as case management, are especially useful for individuals with substance abuse problems (including alcohol and tobacco), mental health conditions (including post-traumatic stress disorder or other mental trauma), transplant recipients, implantable medical device recipients (e.g., knee or hip replacement, pacemaker, etc.), severe trauma or spinal cord injury, diabetes, ulcer, and hypertension. In addition, interventions should not wait for a patient to report disease symptoms; sentinel or critical events, such as systolic blood pressure > 240, should trigger the intervention system.

It will be necessary to prioritize the conditions for interventions with respect to the number of individuals who can be taken care of in case management. The job of case management is to unload the physician, giving more responsibility for care to the case manager. Computerized tracking is especially useful for this purpose.

3. Dr. Dee Edington, University of Michigan, Ann Arbor, Michigan

Dr. Edington has been involved in identifying potentially high resource utilizers as part of M-Care (an HMO of approximately 60,000 people at The University of Michigan) as well as at 11 corporate sites. The instrument used for this identifies the 30% of the population who will be responsible for 70% of the medical costs. The instrument used for M-Care enrollees will involve overall family wellness, asking questions about the entire enrollee's family; instruments used at corporate sites have the employee act as a surrogate for the entire family.

In general, psychological questions (e.g., general state of physical health, life and job satisfaction, stress level, etc) are more predictive than physiological questions. Further, the effect of a

question is age and gender specific. For example, being a smoker at age 55 is more likely to increase resource utilization than being a smoker at age 25. The high-risk 30% identified by Dr. Edington's instrument are then targeted for an intervention developed by Health Decisions, Inc. (see comments by Dr. Wendy Lynch, below). The intervention is designed to contain resource utilization by these individuals before they become high cost.

4. Dr. Wendy Lynch, Health Decisions, Inc., Golden, Colorado

Dr. Lynch and her colleagues have developed an instrument called the Predictor Cost Risk Assessment (described in section I above). Dr. Lynch was unable to described details of this instrument due to its proprietary nature. She indicated that some of the Predictor's items have been validated using retrospective data, and can capture the 30% of the population responsible for 55% of total medical costs. Dr. Lynch stressed that health care utilization is a behavior related to attitudes about health and medical care but largely independent of degree or severity of illness. The best predictors of future utilization are attitudes and prior utilization.

Health Decisions has also developed a series of interventions to prevent at-risk individuals from becoming high cost. These interventions will be used in the system developed by Dr. Edington, as discussed above. Results from the Health Decisions system should be available in approximately one year.

5. Gerald Riley, Health Care Finance Administration (HCFA), Baltimore, Maryland

Mr. Riley has worked predominantly with Medicare and Medicaid populations enrolled in HMOs. This work suggests that functional health status and difficulties with activities of daily living (ADL) are reasonably good predictors of future medical resource utilization. Self-reported chronic conditions and relative health (health as compared to others of the same age) also have some limited predictive ability. Mr. Riley felt that there would be more likelihood of identifying high-cost individuals in Project HEAR as compared to those enrolling in standard insurance programs because predictive instruments associated with standard insurance are used to set rates and individuals may, therefore, answer with less honesty. Dr. Riley also mentioned that some awards have recently been made by HCFA to examine the predictive ability of survey data for HMO medical utilization; these studies are just now starting.

6. Dr. Donald Freeborn, Kaiser Northwest HMO, Portland, Oregon

Dr. Freeborn has worked predominantly with predicting medical expenses for elderly HMO enrollees. He stated that prediction of high resource utilizers over long periods of time is difficult using self-reported data. Self-reported health status, mental health status, and utilization of medical services in the prior year do have some predictive value. Further, for older populations, number of medications being taken (prescription and over-the-counter) is useful in identifying higher utilizers. Number of chronic conditions is also useful, and correlates with number of medications. However, there is a high degree of random variation in medical utilization; the majority is difficult to predict due to situational factors affecting health care utilization.

7. Dr. Nancy Richardson, Stanford University, Palo Alto, California

Dr. Richardson works with Professor John Fries at Stanford developing the Healthtrac program. This program uses data from a one-page questionnaire to define the 20% of the population that will account for 80% of the total medical expenditures. High risk patients are sent to specialized programs; information from this instrument is also sent to patients' primary care managers. A new program focusing on outcomes assessment has recently been added. Participants complete the one-page questionnaire plus the SF-36 health appraisal form one year after completing the initial questionnaire in order to determine changes in health behaviors, practices, and outcomes.

C. Literature and Interview Analysis

A small percentage of the total population is responsible for a large percentage of total medical expenditures. This population remains fairly constant: if an individual reaches high-cost status in one year, he or she is likely to remain high cost in subsequent years. It, therefore, seems feasible to attempt to identify a high utilization population among HMO enrollees.

On an individual basis, only a very small percentage of the variance in total medical expenditures can be explained by any model. Most of the authors have shown that the AAPCC model can be significantly improved. For example, Newhouse et al. (1989) showed that including both health status variables and prior-use variables increased the percentage of the total variance explained from 1.6% to 9.0%. However, 91% of the variance in total expenditures is still unexplained by the model. These disappointing results are consistent with the modeling

results reported in the methods which suggest that the within-person, time-variant component of health care expenditures is dominant and that correlation in costs from year to year is low. Thus, the failure to obtain better predictive models does not appear to be the fault of the authors of the papers or their methods. It appears that it simply is not possible to "explain" more than 10-15% of the variability in future health care expenses for an individual.

An alternative approach that many researchers have recently adopted is to attempt to determine whether an individual will be in a high utilization group. Recent risk prediction instruments have attempted to identify the small fraction of individuals who account for a much larger fraction of costs. The type of information used in the prediction (i.e., the types of variables collected) are not different from those used in the individual-level predictions. The primary difference is in the analysis, as to how the predictor variables are used to create a predictive model. Much of the specifics of these models is proprietary information. However, it should be possible to create similar models given the available literature and a relevant database.

A wide range of sociodemographic, behavioral, and clinical characteristics have been used as predictor variables to attempt to predict resource utilization. Simple predictive models using only age, gender, welfare status, and institutional status explain little of the variation in annual expenses. Additional predictors of value include self-reported health status, functional status, prior health care utilization, absenteeism, chronic diseases, physical symptoms, mental health, health concerns, job/life satisfaction, and stress. Factors not predictive of future utilization include many sociodemographic characteristics (marital status, income, occupation, socioeconomic status), physical activity measures, and certain clinical risk factors (relative body

weight, cholesterol level, blood pressure). Previous studies also demonstrate that it is feasible to conduct health screening at entry to HMO programs to determine LTC service eligibility.

As discussed above, a small population generally has high medical resource utilization in a given year. However, every individual has a greater than zero likelihood of incurring medical costs within a given year. Therefore, models attempting to predict future high resource utilization over-estimated the risk for current low utilizers while underestimating the risk for very high utilizers (Hornbrook et al., 1991).

Prediction of high utilization of PCM time is more difficult because little information is currently available in this area. Some predictors of greater PCM time utilization are medical system characteristics, such as schedule time per patient and lack of physician support staff. However, many of the patient-based predictors for greater PCM time utilization are the same as those for resource utilization; the difference in type of utilization would be reflected in differential analysis of the data. Predictors of greater PCM time utilization include mental health problems, disease severity, and number of morbidities (as would be captured in a chronic disease check-list).

It should be noted that the factors useful for predicting high resource (or PCM time) utilizers will depend on the purpose of this prediction. If this is being performed to implement potentially cost-saving interventions, such as case management, the nature of these interventions and appropriate targets for them must also be defined. The available interventions may define some of the components used for prediction. There is an extensive literature regarding case management and other interventions. Although discussion of this literature is beyond the scope

of this report, it may be useful to assemble a panel of experts in the field of patient interventions (a number of whom were interviewed for this report) to discuss for what type of patients it is feasible to attempt to decrease (predicted) future utilizations.

D. Recommendations

The goal for this objective of Project HEAR is to identify high utilization groups. As in the recommendations for the HEAR component addressing preventive care needs, we recommend including questions on the HEAR instrument based on questions already in use on other instruments. This will allow for comparisons of HMO enrollee characteristics and predicted utilization between TRICARE and other managed care systems. Further, the use of pre-tested questions with known reliability and validity will improve the accuracy of the HEAR instrument and the speed of implementation.

We recommend including the following types of questions on the HEAR instrument to collect data for predicting high utilizers. We envision that these classes of information, along with basic demographic data, can be used to place individuals into groups that are at high risk of resource of PCM time utilization.

a. Prior utilization. Utilization of medical care services during the previous year appears to be the strongest predictor of future utilization. Simple, categorical questions should be asked to avoid recall problems. For example, hospitalization can be captured by asking: have you stayed overnight at least once as a hospital patient (except for pregnancy or childbirth) in the past year. Ambulatory care visits over the past year can be classified into a few categories: 0 to

2, 3 to 5, 6 to 9, 10 or more. Information related to the impact of illness, such as number of restricted days or work days missed, should also be collected.

b. Chronic disease checklist. The presence of chronic diseases also correlates well with future utilization. Enrollees can be asked if they have ever been told that they have certain specific chronic conditions. This list should be based on terms that non-medical personnel are likely to be familiar with: high blood pressure instead of hypertension, heart disease instead of angina. The list should not be overwhelming; perhaps 10 to 12 conditions would be appropriate. Questions should also assess on-going care for chronic disease conditions and the impact of these conditions (e.g., lessened mobility); this will be especially pertinent for retiree enrollees.

c. Attitudes regarding health and mental health. Interviewed experts emphasized that attitudes about health are at least as important as disease and utilization information. Information of this type should include relative health status, stress and satisfaction levels, and some sort of mental health index.

d. Risk factors. The presence of risk factors appears to have a surprisingly low ability to predict future utilization. However, some factors (such as smoking) may be useful, especially when interacting with other sociodemographic or disease characteristics. Fortunately, information related to risk factors will be collected as part of the objective for determining preventive health care needs. Therefore, we do not recommend collecting any additional risk factor information for predictive purposes.

e. Family status information. The lifestyles of military families are different in certain respects from those of their civilian counterparts. For example, an active duty individual may be assigned to a non-U.S. site (or, for Naval personnel, to a vessel), leading to a potentially prolonged family separation. Discussions with military personnel have indicated that such a separation may increase medical utilization by family members. Therefore, collection of family status information including separations and other relevant factors (e.g., risk factors associated with dysfunctional families) will be important. As only individuals 17 or older will be completing the HEAR instrument, it may be useful to ask if the enrollee has a dependent child (less than 17) with a serious medical problem. This will allow TRICARE personnel to make sure that such children have case managers and the parents have appropriate assistance and education.

In addition to selecting questions and developing the proper instrument, an appropriate model must also be designed. This model will be based on previous models described in the Literature Review above, using the data from questions as specified below. Beyond considering individual risk factors associated with high utilization, this model will likely examine interactions of risk factors (e.g., older age and smoking status) and the number of risk factors present. Due to the short time frame for identification of high-utilizers at TRICARE enrollment, the model must be based on pre-determined decision rules rather than overall averages of the enrolled population. It may be useful to obtain data from an existing managed care system to assist in developing and validating this model. We suggest obtaining information from the Lovelace Medical Plan of New Mexico for model development. Lovelace is in a similar geographic region to TRICARE region 6, has extensive research experience, and uses computerized patient databases which will facilitate rapid retrieval and analysis of patient characteristics and utilization patterns.

A separate model must be developed to predict which enrollees are likely to be in the "high PCM time utilization" group. Due to the lack of information in this area, obtaining data from a managed care system with information on use of PCM time would be very important for model development.

In addition, prediction of high utilization for a given year is subject to a reasonable amount of variance; better results have been obtained by prediction over multiple years. As the contract for administering TRICARE is awarded for five year, we recommend identifying high-utilization groups of this period, rather than attempting to identify such groups in a single year.

As discussed above in the Analysis section, the types of utilizers selected for interventions will in part determine the questions asked. It may not be useful to predict that an individual will belong to a potentially high resource-utilizing group, such as older smokers with emphysema, unless an intervention will be targeted at members of this group. While individuals with certain specified diagnosis related groups (DRGs) will automatically be assigned case managers, the interventions for other potentially high-utilization groups need to be considered in developing this prediction model.

As with the preventive care needs component, the computer system associated with the instrument should be developed in tandem with this instrument. A computerized database will be important to determine the accuracy of predicted utilizers, to ensure that high-risk individuals receive their targeted interventions, and to examine the impact of the interventions. Evaluation of the models for predicting resource and PCM time utilization will require collection of data

relevant to these two issues. Provisions should be made to collect the appropriate data and have it in a computerized database compatible with the HEAR instrument database.

V. LEVEL OF PRIMARY CARE MANAGER ASSIGNMENT

A third function for the Project HEAR instrument is to make recommendations regarding the appropriate level of PCM for each enrollee. Individuals enrolling in the TRICARE HMO may interact with a variety of medical personnel, ranging from nurse practitioners to family practice physicians, general internal medicine physicians, and subspecialists. Depending on the conditions and complexity associated with each patient's care, different levels of medical personnel may be providing primary care services. The objective for this function of the enrollment instrument is to assign enrollees to one of three levels of PCM need: low expertise need (nurse practitioners, physician assistants, and general medical officers), intermediate expertise need (family practitioners and internists) and high expertise need (subspecialists). Only the level of PCM will be recommended; suggestions regarding the assignment of specific PCMs is beyond the scope of this project.

Following detailed literature searches and expert interviews, we believe that this objective of Project HEAR has not previously been performed. Therefore, no literature specifically on this topic was available. We reviewed the literature in two relevant areas; differences in patients and outcomes for differing levels of PCM, and descriptions of classification systems which attempt to stratify patients by disease severity or similar characteristics. A summary of these classification systems is presented in Table 5.

A number of experts in the field of patient classification were interviewed. During interviews, the experts were asked about the feasibility of using classification systems to assign PCMs. Their comments are summarized in the interview section. We conclude this section with a brief

analysis of the literature and interviews followed by recommendations for implementing this objective of Project HEAR.

A. Literature Review

1. Differences in PCM regarding patients and outcomes

In order to assign patients to appropriate levels of PCMs, the differences among potential PCMs must be assessed. Several studies have examined differences between family practice and general internal medicine physicians. Franks and Dickinson (1986) studied all 1,989 patients admitted to the adult medical service of Highland Hospital (Monroe County, New York) in 1982 and 1983. Patients of family practitioners had fewer diagnoses than those of internists. No differences were seen in patients cared for by family practitioners versus internists in terms of total charge, length of hospital stay, charges per day, discharge disposition, age, and number of procedures performed. Matched chart review performed on a subset of these patients indicated no significant difference between the two groups of patients in terms of severity at admission (based on APACHE II score) or frequency of re-admission. Further, no significant differences were observed when the two groups of patients were adjusted for case-mix.

McGann and Bowman (1990) used the 1988 MedisGroup comparative database to examine differences between family practitioner and internist patients. A subset of 30 hospitals was selected, balanced in terms of geographic region, size and hospital type. The study examined all patients at least 65 years old who were admitted to these hospitals for the 10 most common

DRGs of internists. A total of 10,353 internal medicine admissions were included; for these 10 DRGs, there were a total of 5,473 family practice admissions. Internal medicine patients were younger, had decreased severity scores, and increased costs as compared to family practice physicians, although the differences were slight. No significant differences were seen in terms of percent of patients experiencing mortality, percent experiencing poor outcome (mortality or major morbidity), or length of stay.

Kravitz et al. (1992) examined data on patients and physicians gathered from Boston, Chicago, and Los Angeles as part of the Medical Outcomes Study (MOS). In each city, one large HMO, several multispecialty groups, and physicians practicing within solo or single-specialty small groups were chosen. Family practitioners, general internists, cardiologists, and endocrinologists were asked to participate. A total of 349 physicians agreed to participate and supplied data on 20,158 English-speaking patients. Disease severity in these patients was assessed by examining the functional status of patients with four common conditions: hypertension, diabetes mellitus, myocardial infarction, and congestive heart failure.

Compared to patients of general internists, patients of cardiologists were older, had worse functional status and well-being scores, and had more chronic disease diagnoses. Patients of family practitioners were relatively younger, had better functional status, carried fewer chronic disease diagnoses, and had lower disease-specific severity scores. Patients of endocrinologists had similar functional status and well-being scores, and similar numbers of chronic conditions. Diabetic patients under the care of endocrinologists were approximately twice as likely as those under the care of internists to be taking insulin, although the severity of illness between these two patient groups was not different.

A small number of reports have examined the role of different PCMs in the military. Panettiere and Mahan (1980) examined all patients referred for internal medicine consultations during a 3-year period at the U.S. Air Force Hospital at Elmendorf Air Force Base (Alaska). A total of 884 patients were seen in consultation. The most common reason for referral was cardiac problems, specifically high blood pressure. Other major reasons included endocrine problems (especially diabetes and thyroid evaluation), gastrointestinal symptoms, pulmonary complaints, and hematology disorders.

2. Patient classification systems

Patient classification systems group patients on a variety of attributes, predominantly disease severity. These severity measures attempt to distill large amounts of clinical information into summary statistics or scores (Iezzoni, 1990). It may be possible to use a severity-based classification system for differentiating appropriate levels of PCM.

As discussed by Arbitman (1986), patient classification systems should have six primary characteristics: medical meaningfulness (patients in each group have similar medical characteristics); homogeneity (patients classified into each group should be homogeneous with respect to the variable used for classification); statistical stability (variation of the classification variable should be small in each group); objectivity (subjective judgements in grouping patients should be avoided); and availability (data used for classification should be available). A number of the systems reviewed by Arbitman (1986) are discussed below.

i) Diagnosis Related Groups (DRGs). DRGs were developed for utilization review with patient groups homogeneous for length of hospital stay. These were later modified to be predictive of hospital resource consumption. DRGs group patients into very broad categories, without separation of patients on the basis of disease severity. Classification is based on clinical diagnosis for hospital in-patients. Similar systems for ambulatory care patients are discussed at the end of this section.

ii) Disease Staging. This classification system was designed to evaluate patient care by grouping patients with similar disease severity. These groups are intended to be useful for predicting the results of medical therapy. Each disease (or specific medical problem) is separated into four different stages based on severity and complications (Gonnella and Goron, 1975): stage I, diseases with no complications or problems of minimal severity; stage II, diseases with local complications or problems of moderate severity; stage III, diseases with systemic complications or problems of a serious nature; stage IV, death. Severity in this index is based on the likelihood of death or residual impairment as the result of a disease without treatment (Gonnella et al., 1984).

Disease staging attempts to link a clinical perspective with outcomes management by classifying patients based on prognosis (Markson et al., 1991). This is useful for evaluating physician efficiency as well as for monitoring measures of medical interventions, especially regarding outcomes for patients of differing severity levels. The system is disease-specific; criteria for stages I through III are determined separately for each disease. This would make the system very expensive and time-consuming to apply to all known disease; consequently, staging has been developed only for major diseases in each etiology or body system class. Stages for these

disease (based on ICD-9 codes) were developed by a panel of 23 clinicians (Gonnella et al., 1984).

Disease staging was applied to a sample of 392,181 discharge surveys from 373 non-Federal short term hospitals in 1977. Analysis revealed that higher stage was associated with increased length of hospitalization, greater number of procedures, patients undergoing surgery, and emergency admissions. Increased length of hospitalization was also associated with increased age within a stage (Gonnella et al., 1984).

iii) Severity of Illness Index. The Severity of Illness Index is a generic classification system, as opposed to the disease-specific Disease Staging system discussed above. Severity of Illness assesses the total burden of illness for patients at hospital admission. Burden of illness is determined by a trained rater, based on seven categories: stage of principal diagnosis; complications of the principal condition; concurrent interacting conditions; dependency on hospital staff; extent of non-operating room, life-supporting procedures; rate of response to therapy (rate of recovery); and impairment remaining following therapy during acute hospitalization. External variables, such as physician differences and hospital characteristics, are not included. This system has been used for predicting patient resource utilization and explaining variance in physician practice patterns. Similar to Disease Staging, each category is given a rating of one to four.

iv) Medical Illness Severity Group Systems (MEDISGRPS). The MEDISGRPS system is a diagnosis-independent severity grouping designed to facilitate measurement of hospital and physician effectiveness. Patients are classified by severity at hospital admission, based on

objective clinical findings. Findings, including those from physical examination, radiology, laboratory tests, and pathology procedures, are each given a weight based on their relationship to increasing or advancing illness. MEDISGRPS values are used to predict length of stay and charges for each patient type, and to determine the effect of treatment on severity over time.

v) Patient Management Categories (PMCs). PMCs were developed using a physician panel to define patient categories and specify management strategies for each category. This system was developed to define patient types and identify the relative costs of therapy. Briefly, development involved 50 disease-specific physician panels, which defined 800 clinically distinct patient categories with associated management strategies. ICD-9 codes were then mapped to each category. All categories and management strategies for this system were developed by physicians in western Pennsylvania, and may not be generalizable to physician practice patterns throughout the country.

vi) Ambulatory Care Group (ACG) System. ACG is a relatively new severity index, designed to be an ambulatory equivalent to DRGs. This system attempts to explain the variation in medical resource utilization by a population, based on its case-mix (burden of illness) (Weiner et al., 1991). Classification in this system is based on several steps. Severity is indexed by first placing patients into 34 ambulatory diagnosis clusters, called Ambulatory Diagnosis Groups (ADGs). Patients are placed in an ADG based on ICD-9 diagnosis codes assigned to them by medical providers. Criteria for assignment to an ADG also includes role of specialty care (general primary care versus specialty care) and severity of condition (Stuart and Steinwachs, 1993). During a single year, an individual may be placed in more than one ADG, similar to potential assignment into differing DRGs for repeated hospitalizations.

These 34 ADG clusters were collapsed into 12 groups (collapsed ADGs, CADGs). Then, based on an individual's various CADGs over time, a patient is placed in one of 25 mutually exclusive major ambulatory categories (MACs). Finally, based on age, gender, and specific ADGs, some MACs are further subdivided to reach a total of 51 mutually exclusive groups, ACGs (Weiner et al., 1991). The ACGs, by including a patient's different diagnosis groups over the course of time, allow better classification of an individual's morbidity mix. Using multivariate analysis, regressions containing ADGs, gender, and age were able to explain 59% of the variation in the rate of ambulatory care visits. Use of a single ACG for each patient (as opposed to multiple ADGs for each) led to a slight decrease in variance explained.

vii) Other ambulatory classification systems

Rogerson (1985) classified ambulatory care into resource consumption groups for purposes of prospective payment. Patient-based and time-oriented indices were created as alternatives to visit-based systems, using patient-years of data (16,835 visits by 871 San Francisco VA Medical Center patients). The study examined three indices based on annual charges, rather than patient visits, for clinical management of ambulatory care. The three indices differed in diagnostic detail and ease of administration. The mean charge per patient-year and coefficient of variation for 1) medical problems, 2) major diagnostic categories, and 3) simplified major diagnostic categories were determined. A Problem Index (P), Major Diagnostic Category Index (MDC), and Simplified MDC Index (SMDC) were used. Patients were 95% male, 66% white, and 33% aged 64 or older. The most common problem was hypertension (<33%), followed by coronary artery disease (20%), non-malignant prostate disease (15%), COPD except asthma (13%), and degenerative disease of the spine (11%). The mean visit charge was \$68, with a coefficient of variation of 90.9. The SMDC Index appeared to be the most appropriate method

of classifying ambulatory care into resource consumption groups. It made the least demands on caregivers and was the easiest to understand and administer.

Patient classification systems have been examined and instruments developed which document workload and staffing requirements for ambulatory care. The NIH Ambulatory Care Research Facility divided care requirements into dependent (e.g., physician orders) and independent (e.g., patient education) activities (Johnson, 1989). Dependent activities differed for each specialty area. Nursing time was documented for all activities, the most common of which were established as critical indicators for dependent care. Patients were classified after a first visit into categories that combined dependent and independent descriptors. An Allocation, Resource Identification, and Costing (ARIC) instrument was adapted from inpatient use to outpatient care to accomplish this task. Three other instruments were also modified and tested (from San Joaquin, Saskatchewan, and Verran's taxonomy). Reliability of greater than 90% was achieved by the ARIC instrument, which was implemented for use in 1988 at NIH. Patient care areas studied did not include mental health and AIDS clinics.

Table 5
Summary of Patient Classification Systems

System	Population	Basis for Classification	Usage
Diagnosis Related Groups (DRGs)	Inpatients	Broad classes of clinical diagnosis	Reimbursement for hospitalization
Disease Staging	Inpatients	Disease-specific severity	Stratification of patients to predict medical therapy outcomes
Severity of Illness Index	Inpatients	Non-disease specific burden of illness	Predict resource utilization, exam differences in physician practice patterns
Patient Management Categories (PMCs)	Inpatients	Disease-specific patient categories	Specify patient management strategies
Ambulatory Care Groups (ACGs)	Outpatients	Pattern of ambulatory care diagnoses over time	Explain variation in resource utilization
Ambulatory Patient Severity (APS) Index	Outpatients (related index for inpatient use)	Disease-specific severity	Manage overall patient care

B. Interviews with selected experts

1. Dr. Johnathon Weiner, Johns Hopkins University, Baltimore, Maryland

Dr. Weiner has been involved in the development of the Ambulatory Care Group system. He feels that this system will not be useful for recommending PCM level. It can be used, to some extent, to predict the PCM time and medical resource needs of patients. However, information for ACG calculation cannot be gathered through surveys; specific information on chronic and acute conditions, including ICD-9 codes, is required. ACGs may be useful for recommending PCM level along with additional data but this could only be done after ambulatory visit diagnoses had been determined.

2. Dan Louis, Thomas Jefferson Medical College, Philadelphia, Pennsylvania

Mr. Louis is the research coordinator for Dr. Joseph Gonnella, who developed the Disease Staging severity index. He felt that Disease Staging in its current state would not be useful for PCM assignment. It would potentially be possible to modify the way in which conditions are staged to make use of self-reported patient information; disease staging could possibly then be used for PCM assignment. However, this modification would require decisions by an expert clinical panel, which would in any event be the most efficient way to develop algorithms for PCM recommendations.

Mr. Louis mentioned that Dr. Gonnella has a contract with HRSA to apply disease staging to survey data from physicians in managed care settings. The purpose of this study is to identify

which patients will physicians treat themselves versus which they will send for consultation (to different levels of PCM). However, this study has not yet started.

3. Dr. Mark Hornbrook, Kaiser Northwest HMO, Portland, Oregon

Dr. Hornbrook had been involved in developing the Disease Staging severity index. He felt that this index was not likely to be of benefit in recommending PCM level, as staging was based on diagnostic information from hospital inpatients. He did not know of any work performed specifically in the area of differential PCM levels. The closest work is in the case management literature, which is almost the reverse problem of the goals for this project; case management involves assigning patients additional medical personnel to assist in coordinating their medical care, not determining the appropriate personnel for their primary care.

4. Dr. Lisa Iezzoni, Beth Israel Hospital, Boston, Massachusetts

Dr. Iezzoni felt that most severity classification schemes would not be appropriate for providing PCM recommendations. These classifications are largely based on severity of illness for acute care hospital inpatients, and projection of PCM needs following acute hospitalization is difficult. Ambulatory classification measures would work better. The Ambulatory Patient Severity index (APS), developed by International Severity Information Systems (ISIS), may work well, as this looks at other factors related to medical care needs, such as level of social support. Dr. Iezzoni recommended speaking with Mr. Paul Gurney of ISIS to discuss this system.

5. Paul Gurney, International Severity Information Systems (ISIS), Baltimore, Maryland

Mr. Gurney described two severity classification systems developed by Dr. Susan Horn and himself (among others) that are sold by ISIS. The Computerized Severity Index (CSI) is a classification for hospitalized patients, similar to the Severity of Illness Index. The Ambulatory Patient Severity Index (ALPS) is similar to the CSI but is used for ambulatory care patients. Both of these indices are disease-specific; severity is based both on the specific diagnosis and the clinical findings. Severity ratings based on combined diagnosis and range of clinical findings were developed by expert panels.

The focus of the ISIS system is risk-adjusted patient management. Patient data, including demographics, risk factors, clinical findings, and encounter records (medical resource utilization) are entered in a database. This information can be entered by hand or from electronically-stored medical records. A severity score is calculated for each medical encounter (ambulatory visit or hospitalization) and for the patient overall. The database allows for patient sorting, analysis, and report generation. It is often used to compare patient outcomes from different physician treatment patterns, leading to clinical practice improvements. The database software is very user-friendly. Planned additions to the ISIS system include a pediatric severity index and inclusion of responses to the SF-36 in the database.

Mr. Gurney felt that the ISIS system could be used both for recommending PCM level and for predicting high resource- and PCM time-utilizing patients. The system is flexible and allows for auxiliary modules (additional data elements) to be included, which may be useable for assessing preventive service needs.

C. Literature and Interview Analysis

A review of the sparse literature in this field suggests that there are not huge differences with respect to patient characteristics or outcomes between individuals cared for by family practitioners and by general internal medicine physicians. There are significant differences between primary care and specialty care physicians; however, these differences may be more related to the subpopulation who requires specialty care. In the military, use of specialists focuses on education and on patients with complex chronic conditions.

A number of severity classification systems have been developed to group patients. Some of these systems (e.g., DRGs) are broad-based with no consideration of patient severity and are largely used for resource consumption purposes. Other systems are disease-specific and do take patient severity into account. However, most of these systems focus exclusively on inpatients and would not be applicable to ambulatory care. Further, most of these systems are not useable with only self-reported data; specific clinical information determined by medical professionals or trained raters is necessary to determine appropriate severity scores. Use of such systems may also be expensive, time consuming, and involve collection of non-routine data.

Ambulatory classification systems may be more useful. These systems are based on patient characteristics and patterns of ambulatory diagnoses over time. However, these systems were not designed to make recommendations regarding PCMs and do not rely on self-reported data.

D. Recommendations

While a number of patient severity classification schemes are in use, interviewed experts did not feel that they were generally applicable to this objective. The main exceptions to this are the ambulatory classification systems. The Ambulatory Care Group system has the advantage of evaluating patients over time based on their pattern of ambulatory diagnoses. The main limitation of ACGs is that the system is not based on self-reported data. ACG classification is based on diagnostic criteria supplied by health care professionals. As such, ACGs can only be used to classify individuals with one or more ambulatory care visit in a given year.

The other main ambulatory system examined was the Ambulatory Patient Severity index (from ISIS), which may be useable for PCM recommendations. However, this system has the same limitation as ACG; self-reported data is insufficient and information supplied by medical professional would be required. Further, the ALPS is part of a global patient management system; adoption of the ISIS system would have implications beyond the scope of this project. Despite these limitation, the ALPS system has a number of interesting features which may be of use to TRICARE for patient management issues. Further discussions with ISIS representatives may be useful regarding the use of this system after TRICARE is in operation (i.e., not for enrollment purposes).

The only feasible method to accomplish the objective of recommending differing PCM levels is by convening an expert physician panel. The mission of the panel would be to develop algorithms for two purposes: first, to determine the best way to separate TRICARE patients into different primary care need categories; and second, to delineate how patients in each

category would be assigned to PCMs. In order to implement this first mission early in the TRICARE enrollment process, the panel would need to recognize that classification and separation of differing types of patients (based on primary care need) would be based solely on self-reported data. It is likely that the desired data for categorizing different types of patients will overlap with the information being collected for preventive service needs and utilization prediction. Prediction of high-utilization groups and assignment of PCM level are closely linked; assignment of case managers or other interventions for high utilizers may indicate the need for greater expertise in the PCM.

The additional data needs for PCM assignment will mainly involve information on the severity and duration of acute and chronic conditions. This information is difficult to obtain, especially in a machine readable form. The most realistic method of capturing this data would be to enlarge the instrument section related to utilization prediction. Additional questions could focus on issues such as length of hospitalizations and the number of medications being taken. Enrollees could also be asked whether they feel they have a serious health problem; if so, they could be asked about utilization (doctor visits, hospitalizations, medications, etc.) specifically related to this problem. Additional information for this objective may be required by the expert panel.

As in the Project HEAR objective related to identification of high-utilization groups, assignment to PCM groups must be performed within a short period of time following TRICARE enrollment. Therefore, the algorithms used for assignment to one of the three PCM need levels must be based on pre-determined decision rules rather than overall averages or other characteristics of the enrolled population.

The second mission, regarding assignment of patients to differing primary care need categories, is both a clinical and logistic issue. For example, if a patient is assigned to an internist but is located only near family practitioners, where should he go? Should all members of a family be assigned to PCMs at the same level, even if this involves providing unnecessarily high levels of primary care to some members (e.g., going to a family practice group when some members could be seen by a general medical officer)? These questions are beyond the scope of this report; however, it will be important to resolve them if information from the first mission is to be effectively used.

BIBLIOGRAPHY

- Acquista VW Wachtel TJ Gomes CI Salzillo M Stockman M. Home-based health risk appraisal and screening program. *J Community Health* 1988 Spring;13(1):43-52.
- Alemi F Stokes J 3d Rice J Karim E LaCorte W Saligman L Nau R. Appraisal of modifiable hospitalization risks. *Med Care* 1987 Jul;25(7):582-91.
- Andersen R Chen M Aday LA Cornelius L. Health status and medical care utilization. *Health Affairs* 1987; Spring:136-156.
- Anderson GF Steinberg EP Holloway J Cantor JC. Paying for HMO care: Issues and options in setting capitation rates. *Milbank Quarterly* 1986;64(4):548-565.
- Arbitman DB. A primer on patient classification systems and their relevance to ambulatory care. *J Am Med Rec Assoc* 1986 Sep;57(9):31-41.
- Arvantes JC Bader BS Veatch R. HMOs invest in health promotion and learn to target their efforts. *Qual Lett Healthc Lead* 1993 Nov;5(9):13-7.
- Bartlett EE Pegues HU 2d Shaffer CR Crump W. Health hazard appraisal in a family practice center: an exploratory study. *J Community Health* 1983 Winter;9(2):135-44.
- Behmer CL Hoffman MA Freeman VS. A multifocal comparison of health status and physical readiness test results of Navy personnel. *Mil Med* 1993 Apr;158(4):248-52.
- Bergner M Barry MJ Bowman MA Doyle MA Guess HA Nutting PA. Where do we go from here? Opportunities for applying health status assessment measures in clinical settings. *Med Care* 1992 May;30(5 Suppl):MS219-30.
- Berki SE Kobashigawa B. Socioeconomic and need determinants of ambulatory care use: path analysis of the 1970 Health Interview Survey data. *Med Care* 1976 May;14(5):405-21.
- Berki SE Kobashigawa B. Education and income effects in the use of ambulatory services in the United States: an analysis of the 1970 National Health Interview Survey data. *Int J Health Serv* 1978;8(2):351-65.
- Berwick DM Budman S Damico-White J Feldstein M Klerman GL. Assessment of psychological morbidity in primary care: Explorations with the general health questionnaire. *J Chron Dis* 1987;40(Suppl 1):71S-79S.
- Borus JF Olendzki MC Kessler L Burns BJ Brandt UC Broverman CA Henderson PR. The "offset effect" of mental health treatment on ambulatory medical care utilization and charges: Month-by-month and grouped-month analyses of a five-year study. *Arch Gen Psychiatry* 1985;42:573-580.

Brazier JE Harper R Jones NM O'Cathain A Thomas KJ Usherwood T. Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care.. BMJ 1992 Jul 18;305(6846):160-4.

Buczko W. Hospital utilization and expenditures in a Medicaid population. Health Care Financ Rev 1989 Fall;11(1):35-47.

Cafferata GL. Marital status living arrangements and the use of health services by elderly persons. J Gerontol 1987;42(6):613-618.

Chen AL Broadhead WE Doe EA Broyles WK. Patient acceptance of two health status measures: the Medical Outcomes Study Short-form General Health Survey and the Duke Health Profile. Fam Med 1993 Sep;25(8):536-9.

Chetwynd J Rayner T. Impact of smoking on health care resource use. New Zealand Med J 1986; April 9:230-232.

Corrigan JM Nielsen DM. Toward the development of uniform reporting standards for managed care organization: The health Plan Employer Data and Information Set (version 2.0). J Quality Improvement 1993;19(12):566-575.

Curtin B. Health hazard appraisal: a tool for health maintenance. J Ambulatory Care Manage 1981 Feb;4(1):65-72.

Curtin B. Health hazard appraisal: a tool for health maintenance. J Ambulatory Care Manage 1981;4(1):65-72.

de Bruin AF de Witte LP Diederiks JPM. Sickness impact profile: the state of the art of a generic functional status measure. Soc Sci Med 1992;35(8):1003-1014.

de Bruin AF de Witte LP Stevens F Diederiks JP. Sickness Impact Profile: the state of the art of a generic functional status measure. Soc Sci Med 1992 Oct;35(8):1003-14.

Diehr P Price K Williams SJ Martin DP. Factors related to the use of ambulatory mental health services in three provider plans. Soc Sci Med 1986;23(8):773-780.

Dlugolecka MJ King SA. A simple tool for heart disease risk appraisal in general practice. J R Soc Health 1989 Jun;109(3):98-9.

Donabedian A. Perspectives on the free choice of the source of personal health care. Milbank Mem Fund Q Health Soc 1981 Fall;59(4):586-95.

England SP. One positive impact of health care reform to physicians: the computer- based patient record. Top Health Inf Manage 1993 Nov;14(2):38-47.

Epstein AM Cumella EJ. Capitation payment: using predictors for medical utilization to adjust rates. Health Care Financ Rev 1988 Fall;10(1):51-69.

Eriksson EA. Continuity-of-care measures: random assignment of patients to providers and the impact of utilization level. *Med Care* 1980;28(2):180-190.

Fielding JE. Appraising the health of health risk appraisal. *Am J Public Health* 1982;72(4):337-339.

Fitzpatrick DT Shannon S. Health-risk behaviors of Army aircrew. *J Occup Med* 1992 Aug;34(8):810-4.

Foege WH Amler RW White CC. Closing the gap. Report of the Carter Center Health Policy Consultation. *JAMA* 1985 Sep 13;254(10):1355-8.

Foxman B Edington DW. The accuracy of health risk appraisal in predicting mortality. *Am J Public Health* 1987;77(8):971-974.

Franks P Dickinson JC. Comparisons of family physicians and internists. Process and outcome in adult patients at a community hospital. *Med Care* 1986 Oct;24(10):941-8.

Freeborn DK Pope CR Davis MA Mullooly JP. Health status, socioeconomic status and utilization of outpatient services for members of a prepaid group practice. *Med Care* 1977 Feb;15(2):115-28.

Freeborn DK Pope CR Mullooly JP McFarland BH. Consistently high users of medical care among the elderly. *Med Care* 1990;28:527-540.

Gellert GA Dillenberg J. Incorporating prevention in managed care (letter to editor). *JAMA* 1993;269(19):2505.

Given CW Simoni L Gallin R. The design and use of a health status index for family physicians. *J Fam Pract* 1977 Feb;4(2):287-91.

Gomel M Oldenburg B Simpson JM Owen N. Work-site cardiovascular risk reduction: a randomized trial of health risk assessment education counseling and incentives. *Am J Public Health* 1993;83:1231-1238.

Gonnella JS Use of outcome measures in ambulatory care evaluation. Giebink GA, White HH (eds), *Ambulatory Medical Care Quality Assurance*, 1977 La Jolla, CA; La Jolla Health Science Publications; 1977; pp. 91-125..

Gonnella JS Hornbrook MC Louis DZ. Staging of disease. A case-mix measurement. *JAMA* 1984 Feb 3;251(5):637-44.

Gonnella JS Goran MJ. Quality of patient care-a measurement of change: the staging concept. *Med Care* 1975 Jun;13(6):467-73.

Gottlieb NH Lloyd LE Bernstein VR. Sex and age differences in lifestyle risk: implications for health promotion programming. *Am J Prev Med* 1987 Jul-Aug;3(4):192-9.

Greenfield S Nelson EC. Recent developments and future issues in the use of health status assessment measures in clinical settings. *Med Care* 1992 May;30(5 Suppl):MS23-41.

Hall J Hall N Fisher E Killer D. Measurement of outcomes of general practice: comparison of three health status measures. *Fam Pract* 1987 Jun;4(2):117-22.

Halpern MT Gillespie BW Warner KE. Patterns of absolute risk of lung cancer mortality in former smokers. *J Natl Canc Inst* 1993;85(6):457-464.

Halpern MT Warner KE. Differences in former smokers' beliefs and health status following smoking cessation. *Am J Prev Med* 1994;10(1):31-37.

Hatsell CP Gaughan DL. USAF health evaluation and risk tabulation program. *Mil Med* 1983 Feb;148(2):122-6.

Heineken PA Charles G Stimson DH Wenell C Stimson RH. The use of negative indexes of health to evaluate quality of care in a primary-care group practice. *Med Care* 1985 Mar;23(3):198-208.

Heyner GC Melby CL. Health risk appraisals: use and misuse. *Family Comm Health* 1985; 13-25.

Hirdes JP Forbes WF. The importance of social relationships, socioeconomic status and health practices with respect to mortality among healthy Ontario males. *J Clin Epidemiol* 1992 Feb;45(2):175-82.

Hoffman PF Stephen FR Bengt JM Anderson V Armstrong R. Ambulatory care teams: the dehauling of Air Force medicine. *Mil Med* 1989 Dec;154(12):613-8.

Hoffman F Wakefield DS. Ambulatory care patient classification. *J Nurs Adm* 1986 Apr;16(4):23-30.

Hoiberg A. Differences in health risks by aircraft model among U.S. Navy pilots. *Aviat Space Environ Med* 1985 Jul;56(7):676-82.

Holt GR Holt JE. The new role of the specialist in primary care military medicine. *Mil Med* 1979 Apr;144(4):256-8.

Hopton JL Porter AM Howie JG. A measure of perceived health in evaluating general practice: the Nottingham Health Profile. *Fam Pract* 1991 Sep;8(3):253-60.

Hornbrook MC Goodman MJ Bennett MD Greenlick MR. Assessing health plan case mix in employed populations: self-reported health status models. *Adv Health Econ Health Serv Res* 1991a;12:233-72.

Hornbrook MC Goodman MJ Bennett MD. Assessing health plan case mix in employed populations: ambulatory morbidity and prescribed drug models. *Adv Health Econ Health Serv Res* 1991b;12:197-232.

Hudak RP Mouritsen PB. Improving the Army's primary care delivery system. *Mil Med* 1988 Jun;153(6):282-6.

Hulka BS Wheat JR. Patterns of utilization: The patient perspective. *Med Care* 1985;23(5):438-460.

Iezzoni LI. Severity of illness measures: Comments and caveats. *Med Care* 1990;29(9):757-761.

Jackson C Jatulis DE Fortmann SP. The behavioral risk factor survey and the Stanford Five-City Project survey: a comparison of cardiovascular risk behavior estimates. *Am J Public Health* 1992;82:412-416.

Janghorbani M Jones RB Hedley AJ. Using the Community Health Index, general practitioner records and the National Health Service Central Registry for a 14 year follow-up of a middle-aged cohort in the west of Scotland. *Health Bull* 1993 Jan;51(1):28-33.

Johnson JM. Quantifying an ambulatory care patient classification instrument. *J Nurs Adm* 1989 Nov;19(11):36-42.

Kannel WB McGee DL. Composite scoring - methods and predictive validity: insights from the Framingham study. *Health Serv Res* 1987;22:499-535.

Kazis LE. Health outcome assessments in medicine: history, applications, and new directions. *Adv Intern Med* 1991;36:109-30.

Kellerman ST Felts WM Chenier TC. The impact on factory workers of health risk appraisal and counseling in health promotion. *Am J Prev Med* 1992;8(1):37-42.

Kiernan M Toro PA Rappaport J Seidman E. Economic predictors of mental health service utilization: a time- series analysis. *Am J Community Psychol* 1989 Dec;17(6):801-20.

Kisch AI Kovner JW. The relationship between health status and utilization of outpatient health care services. *Arch Environ Health* 1969 May;18(5):820-33.

Kosloski K Austin C Borgatta E. Determinants of VA Utilization: The 1993 survey of aging veterans. *Med Care* 1987;25:830-846.

Kravitz RL Greenfield S Rogers W Manning WG Jr. Zubkoff M Nelson EC Tarlov AR Ware JE Jr. Differences in the mix of patients among medical specialties and systems of care: Results from the Medical Outcomes Study. *JAMA* 1992;267(12):1617-1623.

Larson JS. Predictors of international health status. *Eval Health Prof* 1992 Sep;15(3):299-312.

Leahy LM Mouritsen PB. PRIMUS (Primary Medical Care for the Uniformed Services;clinics: their influence on CHAMPUS utilization in military health care catchment areas. *J Ambulatory Care Manage* 1990 Jul;13(3):17-21.

Leigh JP Fries JF. Health habits, health care use and costs in a sample of retirees. *Inquiry* 1992 Spring;29(1):44-54.

Levkoff SE Wetle T Coakley E Kasper J. Determinants of expenditures and use of services among elderly HMO enrollees. *HMO Pract* 1992 Sep;6(3):6-12.

Lubitz J Beebe J Riley G Improving the Medicare HMO payment formula to deal with biased selection. Scheffler R Rossiter L (eds), *Advances in Health Economics and Health Services Research*, Vol 6. JAI Press, Greenwich CT, 1985.

Lynch WD Gilfillan LA Jennett C McGloin J. Health risks and health insurance claims costs: Results for health hazard appraisal responders and nonresponders. *JOM* 1993;35(1):28-33.

Malcolm R Foster HK Smith C. The problem patient as perceived by family physicians. *J Fam Pract* 1977 Sep;5(3):361-4.

Manton KG Stallard E. Analysis of underwriting factors for AAPCC (adjusted average per capita cost). *Health Care Financ Rev* 1992 Fall;14(1):117-32.

Marks JS Hogelin GC Gentry EM Jones JT Gaines KL Forman MR Trowbridge FL. The behavioral risk surveys: I. State-specific prevalence estimates of behavioral risk factors. *Am J Prev Med* 1985;1(6):1-8.

Markson LE Nash DB Louis DZ Gonnella JS. Clinical outcomes management and disease staging. *Eval Health Prof* 1991 Jun;14(2):201-27.

Mason Wb Bedwell CL Vander Zwaag R Runyan JW Jr. Why people are hospitalized: a description of preventable factors leading to admission for medical illness. *Med Care* 1980;18(2):147-163.

McFarland BH Freeborn DK Mullooly JP Pope CR. Utilization patterns among long-term enrollees in a prepaid group practice health maintenance organization. *Med Care* 1985;23:1221-1233.

McGann KP Bowman MA. A comparison of morbidity and mortality for family physicians' and internists' admissions. *J Fam Pract* 1990 Nov;31(5):541-5.

McMenamin JP. Health screening in a general practice by opportunistic recruitment. *N Z Med J* 1992 Dec 9;105(947):495-7.

Miller PL Folse GH. Patient classification and staffing in ambulatory care. *Nurs Manage* 1989 Aug;20(8):29-31.

Miller GH Dear M Streiner DL. A model for predicting utilization of psychiatric facilities. *Can J Psychiatry* 1986;31:424-430.

National Center for Health Statistics. Healthy people 2000 review. Health United States 1992. Hyattsville, Maryland: Pubic Health Service. 1993.

Newhouse JP Manning WG Keeler EB Sloss EM. Adjusting capitation rates using objective health measures and prior utilization. *Health Care Financ Rev* 1989 Spring;10(3):41-54.

O'Bannon JE Mullooly JP McCabe MA. Determinants of lengths of outpatient visits in a prepaid group practice setting. *Med Care* 1978 Mar;16(3):226-44.

Panettiere FJ Mahan JM. Analysis of categories of patients referred to a military internist. *Mil Med* 1980 May;145(5):331-3.

Parkerson GR Jr Gehlbach SH Wagner EH James SA Clapp NE. Muhlbaier LH. The Duke-UNC Health Profile: an adult health status instrument for primary care. *Med Care* 1981 Aug;19(8):806-28.

Peterson KW Hilles SB (eds.) *The Society of Prospective Medicine Handbook of Health Risk Appraisals* (2nd ed). Indianapolis, IN:SPM 1994.

Pope GC. Medical conditions health status and health services utilization. *Health Serv Res* 1988;22(6):857-877.

Radecki SE Kane RL Solomon DH Mendenhall RC Beck JC. Do physicians spend less time with older patients? *J Am Geriatr Soc* 1988 Aug;36(8):713-8.

Rakowski W. The status of health behavior indicators among older adults: focusing on the "health risk" elderly. *RI Med* 1993;76:41-46.

Remington PL Smith MY Williamson DF Anda RF Gentry EM Hogelin GC. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981-87. *Public Health Rep* 1988 Jul-Aug;103(4):366-75.

Rivnyak MH Wan TT Stegall MH Jacobs M Li S. Ambulatory care use among the noninstitutionalized elderly. A causal model. *Res Aging* 1989 Sep;11(3):292-311.

Robertson RL. Health services, health status, and work loss. *J Community Health* 1976 Spring;1(3):175-87.

Rogerson CL Stimson DH Simborg DW Charles G. Classification of ambulatory care using patient-based, time-oriented indexes. *Med Care* 1985 Jun;23(6):780-8.

Roos NP Roos LL Mossey J Havens B. Using administrative data to predict important health outcomes: Entry to hospital nursing home and death. *Med Care* 1988;26(3):221-239.

Rosenberg EE Tannenbaum TN. Measuring health status: an approach for family practice researchers. *Fam Med* 1991 Jan;23(1):52-6.

Rubenstein L Hays R Nelson E Johnson D. Benefits and obstacles of health status assessment in ambulatory settings. The clinician's point of view. The Dartmouth Primary Care COOP Project. *Med Care* 1992 May;30(5 Suppl):MS42-9.

Sacks JJ Krushat WM Newman J. Reliability of the health hazard appraisal. *Am J Public Health* 1980;70:730-732.

Schoenbach VJ Wagner EH Beery WL. Health risk appraisal: review of evidence for effectiveness. *Health Serv Res* 1987 Oct;22(4):553-80.

Schoenbach VJ Wagner EH Karon JM. The use of epidemiologic data for personal risk assessment in health hazard/health risk appraisal programs. *J Chron Dis* 1983;36(9):625-638.

Shi L. The impact of increasing intensity of health promotion intervention on risk reduction. *Eval Health Prof* 1992 Mar;15(1):3-25.

Smith KW McKinlay SM McKinlay JB. The reliability of health risk appraisals: a field trial of four instruments. *Am J Public Health* 1989;79(2):1603-1607.

Smith KW McKinlay SM McKinlay JB. The validity of health risk appraisals for coronary health disease: Results from a randomized field trial. *Am J Public Health* 1991;81(4):466-470.

Sobal J Revicki D DeForge BR. Patterns of interrelationships among health-promotion behaviors. *Am J Prev Med* 1992;8:351-359.

Sorensen A Wersinger R Saward E Katz P. Health status, medical care utilization, and cost experience of prepaid group practice and fee-for-service populations: an analysis of the Rochester, New York market. *Group Health J* 1981 Winter;2(1):4-11.

Spasoff RA McDowell IW. Potential and limitations of data and methods in health risk appraisal: risk factor selection and measurement. *Health Serv Res* 1987;22:467-497.

Spotts HE. Assessing perceived health among older adults: conceptual review and proposed measurement model. *J Ambul Care Mark* 1992;5(1):105-21.

Stein AD Lederman RI Shea S. The Behavioral Risk Factor Surveillance System Questionnaire: its reliability in a statewide sample. *Am J Public Health* 1993;83:1768-1772.

Stuart ME Steinwachs DM. Patient-mix differences among ambulatory providers and their effects on utilization and payments for Maryland medicaid users. *Med Care* 1993;31(12):1119-1137.

U.S. Preventive Services Task Force. Guide to Clinical Preventive Services. Prepublication copy. 1989.

van Vliet RC van de Ven WP. Towards a capitation formula for competing health insurers. An empirical analysis. *Soc Sci Med* 1992 May;34(9):1035-48.

Vogt TM Schweitzer SO. Medical costs of cigarette smoking in a health maintenance organization. *Am J Epidemiol* 1985;122(6):1060-1066.

Vogt TM. Risk assessment and health hazard appraisal. *Ann Rev Public Health* 1981;2:31-47.

Vogt TM. Risk assessment and health hazard appraisal. *Annu Rev Public Health* 1981;2:31-47.

Von Korff M Wagner EH Saunders K. A chronic disease score from automated pharmacy data. *J Clin Epidemiol* 1992;45(2):197-203.

Wagner EJ Berry WL Schoenbach VJ Graham RM. An assessment of health hazard/health risk appraisal. *Am J Public Health* 1982;72(4):347-352.

Wagner EH LaCroix AZ Grothaus LC Hecht JA. Responsiveness of health status measures to change among other adults. *J Am Geriatr Soc* 1993;41:241-248.

Wasson J Keller A Rubenstein L Hays R Nelson E Johnson D. Benefits and obstacles of health status assessment in ambulatory settings: The clinician's point of view. *Med Care* 1992;30(5 Suppl):MS42-MS49.

Weiner JP Starfield BH Steinwachs DM Mumford LM. Development and application of a population-oriented measure of ambulatory care case-mix. *Med Care* 1991;29(5):452-472.

Wells KB Manning W Jr. Benjamin B. A comparison of the effects of sociodemographic factors and health status on use of outpatient mental health services in HMO and fee-for-service plans. *Med Care* 1986;24(10):949-960.

Williams BC Phillips EK Torner JC Ivine AA. Predicting utilization of home health resources: important data from routinely collected information. *Med* 1990;28:379-391.

Wilson A Morrell J. Prevention of heart disease in general practice: the use of a risk score. *Health Trends* 1991;23(2):69-73.

Yen LT Edington DW Witting P. Associations between health risk appraisal scores and employee medical claims costs in a manufacturing company. *Am J Health Promot* 1991;6(1):46-54.

Yen LT Edington DW Witting P. Prediction of prospective medical claims and absenteeism costs for 1284 hourly workers from a manufacturing company. *JOM* 1992;34(4):428-435.

Yen LT Edington DW Witting P. Corporate medical claim cost distributions and factors associated with high-cost status. *JOM* 1994;36(5):505-515.